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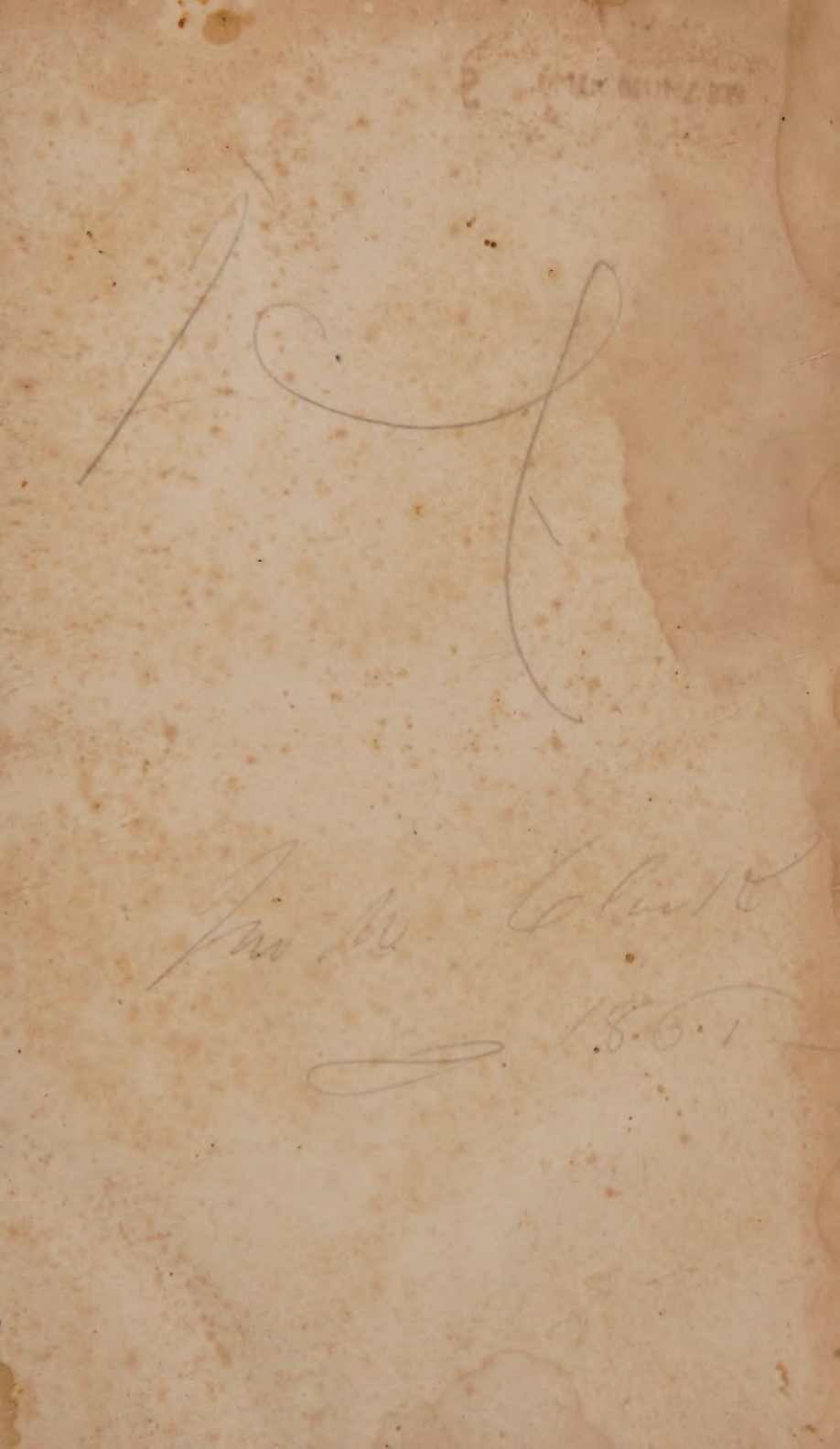

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1861

A TREATISE

ON

THERAPEUTICS, AND PHARMACOLOGY

OR

MATERIA MEDICA.

BY

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A TREATISE

ON

THERAPEUTICS

AND

PHARMACOLOGY.

PART II.

SPECIAL THERAPEUTICS AND PHARMACOLOGY.

CONTINUED.

Division I.

SYSTEMIC REMEDIES.

CONTINUED.

Subdivision 1.

GENERAL REMEDIES.

CONTINUED.

CHAPTER II.

General Sedatives.

THESE are remedies which, by a direct influence, depress the vital actions. I shall treat, under this general head, of the sedatives which may be considered as universal, and afterwards, in separate classes, of those which, though felt throughout the system, have a special direction to some particular part of it, as the arterial, nervous, and cerebral sedatives. The influences which may be regarded as strictly universal are cold, water, and depletion either direct or indirect.

I. COLD AS A SEDATIVE.

As heat is one of the excitant agencies essential to the support of the vital functions at their healthy standard, it follows that cold, which is simply a diminution of heat, must be attended with depression of these functions; in other words, must operate as a sedative; and, as heat is universal in its influence in one direction, so also must cold be in the other.

Though thus directly depressing, cold is in two methods indirectly excitant; first, by the shock produced on the nervous centres through the sensation it occasions; and secondly, by the reaction which follows its primary depressing effect, through the increased excitability acquired by the repose of the function. These indirect influences of cold have been sufficiently considered, the former under the head of the nervous stimulants (i., 597), and the latter under that of the tonics (i., 194). With the depressing effects of cold are combined a contraction and an increased firmness of the tissues, which render it susceptible of various therapeutic applications, already sufficiently considered under the astringents (i., 106). In consequence of its directly depressing and secondarily excitant effects, cold is a prolific cause of disease. In this relation, I have treated of it at length in my work on the Practice of Medicine. Upon the points above mentioned, I must content myself with directing the attention of the reader to the several references just given. In this place, cold is to be considered exclusively in its capacity of a direct sedative.

It will be proper to say, preliminarily, that cold, in reference to impressions made upon the body, is a relative term, applicable to a variable temperature, which depends partly on the conducting power of the substance through which the impression is to be made, and partly upon the heat of the body at the time. Thus, a good conductor of heat, like iron, will feel much colder than a bad conductor, like wool; and a substance which feels cold when the skin is hot, may feel warm in an opposite state of the surface. To obtain the effects of cold, the temperature of the medium must be lower than that of the surface at the time of application. With a view to the sedative effects, water or ice is the medium usually employed; though recourse is sometimes had to the evaporation of volatile substances, as alcohol or ether. The impression is increased, when cold water is used, by maintaining a current over the part; the portion in contact with the surface being thus replaced before

it becomes warm. In relation to the process of evaporation, the degree of cold can be greatly augmented, by blowing over the part by means of a pair of bellows, and thus increasing the rapidity of the evaporation, and, of course, the reduction of temperature. An intense cold can thus be obtained by means of ether, applied to the surface on a single layer of linen or cotton cloth.

1. *Effects of Cold.*

The first effect of the application of a cold body to the surface is the sensation of cold. This is owing to an impression conveyed from the point of application to the cerebral centres, and is really excitant to these centres. It is proportionate to the extent of the surface in contact with the cold body, and to the intensity of the cold. It may be disagreeable, and even severely painful, and sometimes serves to rouse the brain from a torpor into which it may have been thrown by some depressing influence. It was no doubt intended to guard against the evil effects of the cold by exciting attention, and, at the same time, contributing to reaction. But, while the nervous centres are thus stimulated, the part itself suffers a pure depression. The temperature, the circulation, and the special sensibility are all diminished; the surface becomes pale; the tissues shrink; and the peculiar function, whatever it may be, is impaired or suppressed. Perspiration is checked in the skin, the muscles are rendered stiff and unable to contract efficiently, nutrition suffers, and the part feels benumbed, and cannot duly appreciate the contact of bodies. It is true that there is pain in the part, and that a blow upon it is often exquisitely painful; but this is owing to the impression upon the distant nervous centres, and is merely referred by the mind to the part as its apparent seat. Should the cold be removed, reaction takes place; and, even during its application, if it be moderate, a similar tendency is often observable; but, with the continuance of the cold, especially if severe, this soon disappears; and even the capacity of receiving and transmitting impressions to the nervous centres ceases. A sedative effect is produced upon every constituent of the tissue, upon the blood-vessels, nerves, absorbents, and ultimate cells or molecules. There is in it less blood and less nervous action. Nor is it only the part chilled that suffers depression. The same effect is probably experienced, through sympathy, by the interior mucous surfaces. At least this may be inferred from the efficiency of cold, externally applied, in arresting hemorrhage from these surfaces. The blood and nervous

force, diminished in the skin and mucous membrane, must be concentrated in the great trunks and the parenchyma of the organs. Cold applied to the interior, to the stomach for example, has the same effects; and in this case also the sympathy between the outer and inner surfaces is exhibited; for the skin becomes cold, pale, and shrunken, when the impression upon the stomach is strong, and the tendency to reaction is surmounted. Every one is familiar with the great prostration, attended not unfrequently with gastric pains, which follows the drinking largely of very cold water, especially when the surface is perspiring, and the strength so far exhausted by exertion as to interfere with reaction.

If the cold be sufficiently intense, the actions of the part are depressed until they cease altogether. Life, however, is not necessarily lost, even though the part may have been frozen; for, if care is taken to restore the natural temperature gradually, it resumes its functions, and its previous condition. Should, however, heat be too suddenly applied, the reaction is violent, inflammation takes place, and gangrene is apt to result. If, however, the cold be continued sufficiently long, death will take place, in the part at least, so that, upon the reapplication of warmth, circulation within it is not resumed, and it is separated by sloughing.

When the cold is applied so as to affect the whole body, the depression is general, after the first efforts at reaction are past. Every reader is familiar with the effects of intensely cold weather on persons exposed to it without sufficient protection. At first the sensations are severely painful, and the cerebral centres are excited to resist the depressing influence. But, after a time, the sedative power of the cold seems to penetrate the interior of the body, the blood becomes universally chilled, and the nervous centres themselves lose their faculty of resistance. Languor, heaviness, and an irresistible disposition to inaction come on, drowsiness follows, and, if this is yielded to, the patient speedily sinks into a stupor from which he never awakens.

The effects of immersion in cold water are of the same general character, being more rapid and intense in proportion as the temperature of the water approaches the freezing point. The immediate phenomena are the sensation of cold, paleness of the surface, and universal shrinking of the body. When the temperature is but slightly reduced, the feeling is not altogether disagreeable, and reaction soon takes place, with a pleasant sensation of warmth. By a continuance, however, this ceases; and the subsequent influ-

ence is sedative. If the temperature of the bath approaches the freezing point, the sensation produced is intense, amounting to a violent shock upon the nervous centres, with general horripilation, shivering, gasping, or a kind of convulsive inspiration, and not unfrequently tumultuous action of the heart: but the efforts at reaction soon cease, and great depression follows. The skin is pallid or purple in patches, and greatly shrunken; the pulse gradually sinks until it can be felt no longer; severe pains are felt in the head, trunk, and limbs: the muscles and joints become stiff and inflexible; cramps in the extremities are not unfrequently experienced; and at length drowsiness comes on, speedily ending in a fatal stupor.

It must be obvious that an agency so powerful, and capable of producing effects so strongly indicated in many conditions of disease, must be susceptible of very useful therapeutic application. It is not less so that, if used inappropriately, or in excess, it may be productive of vast injury. Hence the danger of an instrument of this kind in uninstructed hands, to which, unhappily, it is too often entrusted.

2. *Indications for the Employment of Cold.*

Indications for the sedative effects of cold are offered in vascular or nervous excitement, in abnormal elevation of temperature, and sometimes when it may be desirable to lessen sensitiveness to pain.

In accomplishing these objects, it is necessary to bear in mind the tendency to reaction under the influence of cold. This must be overcome when the object aimed at is purely depression. Hence, one general rule is to continue the application of cold steadily until the object for which it is applied is accomplished, or until there is greater danger of evil than expectation of good from perseverance with the remedy. Its intermittent application, during the continuance of the nervous or vascular excitement which it is employed to subdue, might endanger an increase of the affection, through the excitement of the intervening reaction. At least one effect would counteract the other; and, if evil might be avoided, no great advantage could be looked for. This rule is peculiarly applicable to the use of cold as an antiphlogistic agent.

Another important practical rule is always to take into consideration the strength of the patient, and to proportion the degree of cold accordingly; a much less reduction of temperature being in general necessary or admissible in a patient of impaired health, and feeble powers of reaction, than in the robust.

The various modes of applying cold have already been sufficiently treated of, unless where some peculiar method may be called for in a special affection. With this exception, therefore, it will be sufficient to refer the reader to the remarks upon cold as an astringent (i., 105), as a tonic (i., 194), and as a nervous stimulant (i., 597).

3. *Therapeutic Application.*

Cold is employed internally or externally, or in both methods conjointly, in acute inflammations, high vascular irritations or active congestions, fevers, diseases of nervous excitement, and as an anæsthetic agent.

a. *Inflammation.*

As a local remedy, cold is often very serviceable in inflammation. It operates by diminishing the quantity of blood in the part, and depressing the nervous irritation, which jointly constitute the main elements of the disorder. It may be used in all *superficial inflammations* of a fixed character, which are attended with increased heat, redness, and swelling. In the readily transferrible inflammations, in which the local affection depends on a constitutional disorder, and, if removed, might be followed by the occurrence of a more serious attack upon one of the vital organs, it should be used with great caution, if at all. Such are the local affections of *gout*, *rheumatism*, and *certain cutaneous diseases* of constitutional origin. The remedy will often act promptly in relieving the inflammation in these cases, and perhaps in the majority of instances might do no serious mischief; but there is always danger; and it is unjustifiable to incur the risk of serious consequences when there is no urgent necessity. Sometimes, however, when the inflammation is very great, with much redness and vascular distention, it may be proper to use the remedy in moderation, with the view of diminishing the violence of the affection, not of subverting it. The cold for this purpose should never be intense. Death is said to have resulted in gout, from introducing the inflamed part into ice-cold water. The refrigerating plan by means of evaporating lotions is more especially applicable to such cases; and alcohol is preferable to ether for the purpose, as it is less liable to reduce the temperature too far. It should usually be diluted with water, camphor water, or some demulcent liquid, and applied on thin compresses, so as to admit of evaporation. Two or three parts of the diluent may be mixed with one of alcohol. I have

sometimes used in this way a mixture of tincture of camphor and milk, the latter of which acts as a demulcent as well as diluent. Scudamore employed in gout an evaporating lotion consisting of one part of alcohol and three of camphor water. Demulcent liquids, such as infusions of slippery elm or flaxseed, act partly by the cold they occasion through the conducting property of the water. These are used with great advantage in *erysipelas*, and severe cases of *erythema*, such as *E. nodosum*. The *inflammation from burns or scalds, wounds, sprains*, and *bruises* is very usefully treated by cold water, applied to the part on compresses, and kept cold by frequent renewal. The degree of cold should, in such cases, be regulated by the sensations of the patient, and should not be lower than is agreeable to him. When productive of general chilly sensations, it should be omitted. *Subcutaneous phlegmonous swellings*, and *inflamed glands*, may be treated in the same way; but, generally speaking, emollient applications answer better in these cases. Few remedies are more efficient than cold water in *inflamed piles*; and, when they are internal, frequent injection of the same remedy into the rectum is often beneficial. In *inflammation of the conjunctiva*, cold water applied by compresses over the eye is usually very grateful to the patient, and beneficial so long as it continues grateful. In some instances, warm water is more soothing, and may be preferably used. The *inflamed throat of scarlatina*, with much swelling externally, is treated by some with ice-cold water, applied on compresses over the parotids and submaxillary glands, and with asserted advantage.

Of the *internal inflammations*, that of the *meninges of the brain* especially calls for this remedy. With or without shaving of the hair, large compresses thoroughly soaked with ice-cold water, or bladders filled with pounded ice, or cloths enveloping a layer of snow, should be applied over the whole scalp, and renewed from time to time; care being taken not to freeze the skin. *Inflammations of the chest and abdomen* are not generally treated with cold externally; and I have no doubt that when the parenchyma of the organs is affected, it might prove injurious by sending the blood into the inflamed tissue; and the same is probably the case with the serous inflammations of these parts. But in *inflammation of the mucous coat of the stomach, bladder*, and *uterus*, it is not impossible that the sympathy between the external surface over the part affected, with the mucous membrane, may cause the latter to be favourably impressed by cold applied to the former. I confess,

however, that I never myself employ cold in these cases, preferring the sedative effect of emollient cataplasms in all the internal inflammations of the trunk of the body.

Internally, however, cold may be employed with much benefit in *acute gastritis*. The burning pain and the great thirst of this affection call for cold drinks, and nothing is more grateful to the patient. I believe that nature here points out the true proceeding. But water should not be drank copiously, as, by distending and weighing upon the stomach, it may prove mechanically injurious, and is liable to provoke vomiting. It should be taken as cold as possible, in very small quantities, one or two swallows for example, at a time, and very frequently. An excellent plan is to let the patient swallow frequently small pieces of ice, without allowing them to dissolve in the mouth. Their solution in the stomach, through the absorption of free caloric, creates a much greater degree of cold than would be occasioned by the same bulk of water; and the stomach may in this way be kept constantly refrigerated. There is little danger of proceeding too far, if the pieces be swallowed separately at short intervals, and no longer than they prove comforting to the patient.

In *acute dysentery*, the plan of injecting ice-water has also been recommended; but, unless the injection were very frequently repeated, which in itself would be objectionable, there would be risk that the reaction in the intervals would quite balance the direct sedative effects of the remedy; and ice, if introduced, would be too local in its operation, not being capable, as in the stomach, of diffusing itself when dissolved over the whole inflamed surface.

A new method of employing cold in inflammation has been introduced into notice by Dr. James Arnott of London. It consists in freezing the part by a mixture of pounded ice and salt. I have myself had no experience of this method, and can, therefore, say nothing of it of my own knowledge; but the extraordinary results obtained by Dr. Arnott are certainly entitled to attention. Of the mode of forming and applying the mixture, and of its effects, I shall treat under the anæsthetic application of cold. It is sufficient here to say that, in the experience of Dr. Arnott and his friends, no injury has resulted from the use of the remedy in any case. He considers it capable of promptly curing any inflammation the seat of which can be reached by the freezing influence, and of benefiting internal inflammation through the sympathies connecting the surface with the interior. The affections in which Dr.

Arnott has found the remedy successful are *erysipelas*, *eczema*, *impetigo*, *prurigo*, *glandular inflammation of the neck and groin*, *acute lumbago*, *sciatica in most instances*, *most cases of chronic rheumatism*, *ordinary inflammation of the joints*, *painful nodes*, and the *inflammation of sprains*, *bruises*, *and burns*. In *acute rheumatism*, the inflammation of the joints is invariably and completely relieved, and the disease shortened to a week. *Rheumatic gout* is also promptly relieved; *ophthalmia* has been immediately cured by a frigorific mixture in contact with the closed eyelid for three or four minutes; the beneficial action of the remedy in *orchitis* is very prompt; and Dr. Arnott has employed it with "speedy and excellent effects" in a case of meningitis, and in another of *peritonitis*. (*Ed. Month. Journ. of Med. Sci.*, July, 1854, p. 35.)

b. *Vascular Irritation.*

The topical use of cold is beneficial in this condition for the same reasons precisely as in inflammation. In *vascular irritation* or *active congestion of the brain*, it is almost indispensable. This condition exists frequently in *fevers*, with or without delirium, and often yields happily to the remedy. Cold water, ice, or snow may be employed in the manner already indicated; or the water may be allowed to fall in a single stream, or in a shower, by means of a colander, upon the head of the patient, from a foot or two above him, and run off by some convenient arrangement, so as not to wet the remainder of the body, or the bedclothes. The same remedy should be used in all cases of *threatened or existing apoplexy*, when the face is flushed and the head warm. In *convulsions*, with the same phenomena, cold water or ice to the head is often highly beneficial, and may not unfrequently be employed with advantage simultaneously with hot pediluvia, or the warm bath. This remark applies to all kinds of convulsion, whether in children or adults, when the head is flushed and heated. In the *convulsions of puerperal women*, the remedy has been highly commended. The water first employed should be tepid or about 90° F., and its temperature diminished gradually to 80° F., 70°, or somewhat lower. It should be poured by pailfuls over the head of the patient seated in a bathing tub, or immersed in a tepid bath of about 90°. In severe *headaches*, which have resisted ordinary measures, the same plan may be employed.

In *vascular irritation of the stomach* ice or cold water is not less indicated than in gastritis. In severe vomiting from this cause, it

may be used both internally and to the epigastrium. In *cardialgia*, the drinking of cold water is useful not only by the cold, but also as a simple diluent to weaken the acrimony of the gastric contents.

Irritation of the genital organs is often happily treated with cold water. No remedy usually affords more prompt relief in the painful priapism of gonorrhœa, or in the same affection from other causes.

c. *Febrile Disease.*

In all *febrile diseases* with a hot, dry skin, hot breath, and thirst, the sedative influence of cold is strongly indicated. It may be applied by means of cool fresh air inhaled into the lungs, which in general proves grateful and refreshing. For this purpose the air of the chamber should be frequently renewed, and the temperature not allowed to exceed from 70° F. to 76°, according to the season, if the weather permit. Care, however, should be taken to guard the body against undue exposure to cold, and it should therefore be kept covered, especially when the surface is damp, and the patient disposed to chilliness.

Cool drinks are still more refreshing; and small sips, frequently taken, of *iced lemonade*, *orangeade*, or *pure iced water*, should be permitted in all cases, when desired by the patients under the above circumstances. When the mouth and fauces are hot and inflamed, small pieces of ice may be held in the mouth and allowed slowly to dissolve; and, when gastritis exists, with burning heat of stomach, and perhaps vomiting, the ice may be swallowed undissolved, as before recommended in the same affection occurring as a distinct disease.

Externally, too, cold may often be applied with great advantage. Dr. Currie, of Liverpool, distinguished himself by introducing into use this measure, not only as a palliative, but as a cure for fever. His method was to strip the patient naked, and, seating him in a tub, to pour over him four or five gallons of water from 40° F. to 60°, and to repeat the process two or three times, or until rigors should come on; after which he was to be wiped dry, and put immediately into a warm bed. Reaction soon took place, attended with diaphoresis, which was sustained by the free use of tepid drinks. The remedy thus employed operates not only by the depressing influence of the cold, but in several other ways also; as by a shock on the nervous centres calculated to interrupt the associated morbid actions, by the reaction which follows, and by the promotion of sweating. But, powerful as it is for good when properly used,

it may, under other circumstances, be productive of serious injury. Dr. Currie, therefore, gave some rules to guard against the abuse of the remedy, which are highly judicious. The temperature of the body, as ascertained by a thermometer under the tongue, should be at least 96°, the skin should be considerably hotter than in health, and *perfectly dry*, and there should be *no sense of chilliness* present, and no *existing internal inflammation*, especially of the chest. In women, moreover, the measure should be avoided during the menstrual period, and in the advanced stage of pregnancy. It is usually best that the hair of the head should be removed before the affusion. Some fevers may be much benefited, and even cut short by this remedy. Such are the proper typhus, and the miasmatic remittent, or bilious fever. It might possibly also prove serviceable in yellow fever. It is inapplicable to enteric or typhoid fever and the exanthemata; to the former, because the disease cannot be cut short by this or any other measure, and, moreover, in consequence of its complication with or tendency to internal inflammatiou, especially bronchial; to the latter, because there might be serious danger of an introversion of the irritation, which might fix with fatal violence on some vital organ. In cases to which it is applicable, if in their advanced stage, the temperature of the water should not be more than 20° F. below that of the surface of the body.

In all febrile diseases, however, when the skin is very hot and dry, and no sense of chilliness exists, *the application of cold by sponging with cool water* may be employed without hesitation; due care being taken to graduate the temperature to the sensations of the patient, and the extent of the application to the degree of vital force. In the exanthematous fevers, moreover, the disposition to retrocession must be taken into consideration; and, when this is liable to happen, the remedy should be used with caution. When strongly indicated, the sponging may be applied over the whole body; in other cases, it may be confined to the extremities and the face. The temperature of the water should be such as to be agreeable to the patient, and never so low, under these circumstances, as to produce general chilliness or rigors. A few degrees below the temperature of the surface, say from 10° to 20° F., would be quite sufficient.

In the *headache or delirium of fever*, or whenever determination of blood to the head is observable, cold water may be applied to the scalp in the manner already described. (See *page* 9.)

d. *Nervous Irritation.*

In spasmodic affections of different kinds, cold has been found useful; as much, however, probably by its nervous stimulant property, or shock on the nervous centres, and by its indirect tonic powers, as by its purely sedative influence. Still it would seem to be clearly indicated, in reference to the last effect, in disorders consisting in irritation or morbid excitement of the nervous system; as it unquestionably acts as a direct sedative to this as well as the arterial system, when the first excitant shock of the sensation is passed. Its usefulness in *convulsions*, by application to the head, has been already mentioned.

Spasm of the stomach will sometimes give way to the sudden application of cold to the epigastrium; and I have seen spasm of the bowels which has resisted every other measure which I could employ, yield immediately to a stream of cool water, poured out of a pitcher from the height of three or four feet upon the abdomen, while the patient lay upon his back on the floor. The measure may be tried also in *obstinate spasms of the ureter*, *hepatic ducts*, *bladder*, and *rima glottidis*, after other means have been exhausted.

The powerful sedative action of cold affusion, and of the cold bath, at a temperature between 40° and 50° Fahr., has been repeatedly resorted to with success in *tetanus*. The vital actions are greatly reduced; and, in this state of reduction, the spasms relax. Should they return, the same measures should be repeated, at proper intervals; care being taken not to depress the powers of the system too far. After being removed from the bath, the patient should be placed in bed, wiped dry, and stimulated, if necessary, by carbonate of ammonia or hot spirituous drinks. Great caution, however, is required not to depress the patient below the point at which reaction can take place. Immediate death has resulted from the use of the cold bath in tetanus.

In various conditions of *hysterical disease*, cold water may be used to calm the nervous excitement. Irregular contractions of the involuntary muscles, various internal spasms, palpitations, epigastric uneasiness, flatulence, &c., may often be relieved by cold water administered by enema, or applied by a sponge to the epigastrium, the chest, or along the spine, or by immersion for six or eight minutes in a cool bath, between 60° and 80°.

In the *paroxysms of maniacal violence*, the cold shower-bath, or affusion upon the head of the patient, is one of the most powerful methods of producing calmness. The application should cease with

the violence of the excitement; and may be renewed with its renewal, until the patient is permanently quieted. Close watching is requisite to prevent too great depression. One minute is often sufficient, and five or six minutes should be rarely exceeded when the water is very cold.

e. *As an Anæsthetic Agent.*

Though intense cold produces pain, and at first increases the sensitiveness of the part to painful impressions, as to that of a blow for example, yet after a time it completely benumbs the nerves, and quite suspends sensibility. This happens, in a considerable degree, before positive freezing takes place, and always completely afterwards. Ice is sometimes employed for this purpose, in the relief of *neuralgic pains.* When these are superficial, ice or ice-cold water, applied so as to produce a benumbing effect, will sometimes afford relief, and may be tried when other measures have failed. Dr. Arnott has found the frigorific mixture, applied so as to freeze the surface, often promptly successful in *headache*, *toothache*, and *neuralgia* of the face, side, and other parts, though it has often also failed. (*Edinb. Monthly Journ. of Med. Sci.*, July, 1854, p. 37.) But it is rather as a surgical anæsthetic that extreme cold has recently attracted notice. To Dr. James Arnott, as before stated, the profession is indebted for this application of cold; and, from the reports made in its favour, it is certainly an important addition to the resources of our profession. The following remarks on the method of using it, and its effects, are taken mainly from the communications of Dr. Arnott.

The frigorific mixture used consists of two parts of powdered ice and one of fine table salt. For most purposes, four ounces of ice, or a piece about as large as an orange, will be sufficient. This should be thoroughly comminuted by shaving with a plane, or pounding it in a bag of canvas or coarse cloth, and then placed on a sheet of paper, and mixed quickly and intimately with the salt, by means of an ivory folder, or by stirring the two in a gutta percha vessel. The mixture thus prepared is to be introduced into a net of gauze, which may be conveniently suspended for the purpose from the mouth of a jar; and, as soon as drippings of brine begin to appear, it is ready for use. The net inclosing it is now to be applied to the part horizontally placed, and, if not large enough to cover the surface which it is wished to affect, is to be passed quickly from one part of it to another, so as to operate on

the whole equably. The liquid which escapes may be received upon a wet sponge, or in a basin placed beneath. Another method of effecting the object is to use a brass ball which has been immersed in the freezing mixture; or, when only a small surface is to be operated on, a thin metallic spoon containing a portion of the mixture.

A certain degree of numbness is immediately produced, and the skin rendered pale, with little disagreeable sensation even of coldness. In half a minute, the whole surface is suddenly blanched, and a feeling of tingling or pricking is experienced like that caused by mustard. If the application be continued, the adipose matter becomes solidified, and the whole tissue hardened, with a slight tingling pain, which, however, except in peculiarly sensitive parts, as the hand, and anterior and lower part of the forearm, is rarely complained of. This uneasiness soon subsides, and perfect insensibility takes place. The time required for producing the effect varies with the condition of the surface. If this be perfectly sound, not more than one or at most two minutes will be necessary: if inflamed, as in an abscess, from six to ten minutes may be required. The insensibility remains for many minutes after the removal of the mixture. The part, when insensibility is no longer required, should be gradually restored to its normal condition by covering it with pounded ice, or a bladder containing ice and water. This will not be required in cases in which the refrigerating process is checked before the freezing effect has been produced. Upon the thawing of the part, some redness and dilatation of the blood-vessels may result; but this, so far from being inflammation, is a state of debility, which permits distention through the *vis a tergo*. In fact, the part is, under these circumstances, quite indisposed to take on inflammation, generally if cut heals kindly by the first intention in twenty-four hours, and never suppurates; nor does inflammation occur in the neighbouring parts. Dr. Arnott asserts that he has never known any injury result from the process, and his statement is confirmed by others. There is not the least danger of gangrene.

The resulting hardness is quite different from that of frozen water, as it is only the fatty matter that is consolidated; the blood being driven out by the contraction of the vessels. It can be cut readily, but requires that the knife should be held somewhat more firmly in the hand than in the ordinary condition of the tissues. There is, of course, no hemorrhage from the frozen parts. For

slight operations it is not necessary to produce the full freezing effect.

As the congelation does not penetrate more deeply than the skin and the adipose tissue immediately subjacent, the measure is not calculated to obviate the suffering from extensive operations; except in so far as it renders perfectly painless the first incision through the skin, which is usually the most painful part of the cutting. It is more especially the smaller operations to which this anæsthetic measure is appropriate; but, as these are much more numerous than those of greater importance, its beneficial influence will be widely felt, if all that it promises should be fulfilled. It is perfectly safe, and thus has an incalculable advantage over chloroform, which has frequently caused death, when employed in cases to which the present measure is adapted.

The operations to which, according to Dr. Arnott and others who have tried the plan, it is peculiarly appropriate, are those for *cutaneous* or *small subcutaneous tumours*, the *opening of abscesses*, *paronychia*, *carbuncle*, the *forming of setons and issues*, *scarification*, *paracentesis*, the *cutting down upon arteries*, the *tying or cutting of varicose veins*, *phymosis*, *strangulated hernia*, the *evulsion of nails*, and the various *ophthalmic*, *dental*, *plastic*, and *orthopædic operations*.

The advantages of the measure are its safety, the absence of hemorrhage, the want of subsequent inflammation or suppuration, the healing by the first intention, and the non-occurrence of inflammation in the neighbouring parts.

The preceding observations have been gathered from various communications, most of which are contained in the *Lond. Med. Times and Gazette* (March, 1854, p. 285; Nov., 1854, p. 488; and Nov., 1855, p. 518), and the *Ed. Monthly Journ. of Med. Sciences* (July, 1854, p. 32).

Among the surgeons who have put in practice the process of Dr. Arnott, and have spoken of it favourably, are Velpeau of Paris, Coste of Marseilles, who has met with results in the highest degree favourable (see *Med. Times and Gaz.*, Nov., 1855, p. 518), Paget of London, and Dr. J. Mason Warren of the United States (*Bost. Med. and Surg. Journ.*, lii. 35).

f. *As a Prophylactic Agent.*

Cold may with great advantage be employed as a preventive of those affections which it is apt to produce. It is probably the most frequent cause of inflammations; but, as the system

may be gradually accustomed to almost any disturbing agent not directly affecting its organization, the morbid influence of cold may be in great measure obviated by putting this principle in practice. The face and hands have been so accustomed to cold, that the system is rarely affected through them by that morbid agent. Allow other parts of the body to come into a similar relation to cold, and the same result will take place for all. The naked Indian, when asked why he did not suffer from cold, very pertinently answered that he was all face. Without departing from the usages of civilized life, we may in considerable degree acquire the same immunity. This is accomplished by the daily use of the cold bath, or the cold shower bath; and even the simple introduction of the feet into very cold water, or washing the back of the neck and upper part of the chest, every morning, will have very considerable prophylactic efficacy. But persons accustomed to take cold easily, liable, for example, to frequent attacks of angina, bronchitis, or rheumatism, should not, especially if of feeble constitution, too hastily adopt the measure during cold weather. The best plan is to begin with general or local bathing in the summer, using water of the ordinary temperature, and to continue regularly the same practice with the advancing season, so that by the middle of winter, the system will have gradually become accustomed to a cold, equal, or nearly so, to the average temperature of the air. One rule, which must always be observed, is never to use the water so cold, or to continue the use of it at any one time so long, that efficient reaction shall not take place immediately after the application has ceased; and the reaction should be assisted by friction with a towel, which serves at the same time for drying the surface, stimulating the skin, and exciting the heart through the muscular exercise.

II. WATER AS A SEDATIVE AGENT.

A certain proportion of water is essential to health and life. It is necessary, mechanically, in order to give a due mobility both to the liquids and solids, enabling the former to move from point to point as may be required by the wants of the system, and the latter to act molecularly, or in mass, in the performance of their several functions. It is also necessary, dynamically, in order that a proper balance may be maintained between the excitant agencies and the susceptibilities of the system; in other words, that the fluids, which

serve to keep the various functions in their healthful state of action, should be neither excessively nor deficiently excitant. It is obvious that an excess of water must, in both these relations, have a sedative effect. In the first place, if in quantity more than sufficient to enable the constituent molecules of the tissues and the blood to move duly in the exercise of their offices, it must have the effect of separating them beyond the sphere best adapted for their mutual reaction, to lessen, consequently, the vital cohesion between them, and thus to occasion at once relaxation of the tissues themselves, and a failure in their functions. In the second place, a similar excess, by diluting the fluids of the body, disturbs the balance above referred to between the excitant agencies and the vital susceptibilities, diminishing the force of the former, and consequently the functions which depend upon a due excitation of the latter. It follows that a universal reduction of the vital actions must ensue from an excess of water in the system; and a similar reduction in those of any one part to which this excess may be confined. But it is not a diminution of function only that takes place. There is for the time being a positive reduction also of power. The tissues, of which the molecules or ultimate organic constituents are too far separated to be capable of due mutual reaction, have no longer the healthy capacity of receiving impressions, or of performing functions. Their excitability and strength, as well as their action, are depressed. Hence one great difference between the sedative properties of cold and those of water. The former depresses action, but leaves the power unimpaired, while the excitability is increased by rest. It is, therefore, followed by reaction, and thus proves secondarily stimulant. The latter is purely sedative, and is followed by no reaction. The difference is highly important in a practical point of view; as it renders water often applicable as a sedative, when we might be deterred from employing cold by apprehension of the reaction which must ensue.

But there is one aspect in which an excess of water may seem to be stimulant. In order that it may be eliminated, the urine, perspiration, and pulmonary exhalation are increased; and the functions by which these effects take place, may be supposed to be stimulated by the liquid. The exception, however, is merely apparent. It is not the characteristic ingredients of the urine or perspiration, nor the proper secretion of the bronchial mucous membrane that are thus increased; it is merely the proportion of water. The proper secretory function is not augmented, but sim-

ply the mechanical elimination of water consequent on the distension of the vessels. It is highly probable that the true secretory function, the result of the cell action, is diminished with all the other functions. This effect of water in apparently promoting the secretions will be noticed more particularly under the diuretics and diaphoretics; at present we are concerned only with its obvious sedative effects.

1. *Effects on the System.*

It results from what has been said above, that water is sedative partly by diluting the blood and other fluids of the body, and thus rendering them less capable of exciting the various functions, and partly by entering into the solid tissues, separating their ultimate organic constituents, and thus diminishing their vital cohesion, and their power to act. It has these effects, whether swallowed, injected into the rectum, or applied to the surface of the body.

In estimating the effects of water, it is necessary to take into consideration its relations with caloric. When applied to the body so as to cause the sensation either of heat or cold, it is not the water only that acts, but the temperature, and the latter mainly. Hence, hot water is stimulating, and cold water directly depressing, but indirectly stimulant through reaction. The peculiar influence of the fluid is apparently lost in that of the heat or cold. To obtain the unmodified effects of water alone, we must employ it at the temperature of the surface to which it is to be applied. It must feel neither hot nor cold, but simply lukewarm when used externally, and in a slight degree warmer when taken into the stomach, so that it may have the same temperature as that organ. This is a practical rule of the utmost importance in the use of water as a sedative. By erring on either side, we fail of procuring the intended effect; stimulating directly or indirectly, instead of depressing, without tendency to reaction, which is the characteristic operation of water itself. It is, therefore, of *warm* or *lukewarm water*—that is, of water alone, unmodified by temperature—of which we are now to treat.

If *warm water is taken into the stomach* considerably beyond the wants of the system, so long as it remains in that viscus it dilutes its contents, lessens their excitant influence on the secretory function, and causes a diminished production of gastric juice, and consequent defect of digestion. Penetrating the gastric tissues, it relaxes both the mucous and muscular coats, and thus also impairs

the function, while it directly weakens the organ. The nervous structure is involved in the same depressing influence, which makes itself felt, through the extensive sympathies of the stomach, in nausea, feebleness of the pulse, paleness and relaxation of the surface of the body, general languor, faintness, and muscular prostration. These effects are sustained by the rapid absorption of the water into the veins, and the consequent dilution of the blood, which is thus rendered less excitant, and less able to support the various systemic actions at their healthful standard. Few agents are more depressing to the whole system than warm water taken freely into the stomach. At length, however, if continued, it is apt to provoke vomiting, partly by its nauseating effect, and partly by the distension of the organ; after which there is usually a disposition to repose, if not sleep. The water which has entered the blood is eliminated from the system either by perspiration or urine; the one or the other of these excretions being promoted, according as the surface of the body is kept warm or cool. The excess of water having been thus thrown off, the system gradually rises to its normal condition, without any tendency to exceed that point.

The *external application of warm water* is productive of the same effects, qualified by the extent of surface affected. I shall first treat of its application, in the form of bath, to the body generally, and afterwards of its more restricted use.

Warm Bath. The term *warm bath* is usually employed when the temperature is high enough to produce a decided sensation of heat, that of *tepid bath* when it is somewhat lower, so as scarcely to occasion any sensation whether of heat or cold. For our present purpose, it is not worth while to make the distinction. The warm bath, as the term is here understood, implies any temperature which, at the moment of immersion, occasions neither a feeling of coolness, nor a disagreeable feeling of heat. As expressed by degrees, this temperature varies considerably, according to that of the surface of the body at the time. What would be cool to a patient in a fever, would be hot to another in a chill. In general terms, it may be said that the heat of the warm bath, as here meant, may vary from 85° to 100° Fahr.; the mean perhaps being in health between 90° and 95°. Generally speaking, a moderate sensation of heat at the first entrance is not amiss; for the stimulant effect is slight, and passes off in a short time, so that the influence very soon becomes purely sedative; while, for the purposes for which the bath is usually employed, it is desirable to avoid the least sensation of chilliness.

Immediately after immersion, there may be a slight excitation of the pulse and of the surface; but this is of no account in reference to the general effects. These are very soon of a calming or soothing character. An agreeable feeling of languor is experienced; the pulse becomes slower, softer, and weaker; the respiration is similarly diminished; and after a time a disposition to sleep is not unfrequently induced. The skin becomes softer, swells, and wrinkles; and the volume of the body is increased. A considerable portion of water is absorbed, and a disposition to micturition often takes place, with the passage of light-coloured and transparent urine. The general depression gradually increases, till at length uneasy sensations begin to be experienced, nausea and faintness are not unfrequently felt, and cramps in the limbs indicate that the nervous centres are suffering. How long this depressing influence can be supported it is impossible to determine exactly; but days have been passed in the water.

The length of time for remaining in the bath has no precise limit. It may be for fifteen or twenty minutes only, or may be protracted for hours. The patient before entrance should try the temperature, so as to ascertain that it corresponds, as near as may be, with that of his body. During the immersion, care should be taken to maintain the proper temperature by withdrawing, from time to time, portions of water from the bath, and replacing it by warmer water. Upon being removed, the patient should be placed between blankets, or warmed sheets, and wiped dry with warm towels; and no sense of chilliness should be permitted to be felt. Hence it is important that the air of the chamber should be warmer than is required under ordinary circumstances; not less, probably, than from 76° to 80° Fahr.

Local baths, as the *half-bath*, *hip-bath*, and *foot-bath*, have similar effects, though proportionably less in degree. They of course act most powerfully upon the parts to which they are applied, softening, swelling, and relaxing the tissues, depressing the capillary circulation, and lowering the nervous force; but they in some degree also influence the system, partly perhaps by the absorption of water, though probably still more by interfering with the ordinary influences sent to the nervous centres. It may be presumed that, in health, these centres are kept in their just equilibrium by an influence sent up to them from all parts of the system in reciprocation of their own. The loss or diminution of this influence from any one portion of the body, depresses the centres correspondingly;

and more or less of a general sedative effect is thus produced. Even the foot-bath, continued for some time, sensibly affects the system.

Cataplasms and *fomentations* are other methods for the local application of water, with a view to its sedative effect. The former is the more efficient of the two, because longer and more continuously employed. For this purpose, cataplasms should be made with materials entirely bland, and simply serving as a vehicle for the water, which is the only effective agent. For materials suitable to the purpose the reader is referred to the class of emollients. Through the absorption of the water, the skin is softened and thickened, the blood in the part is diluted, the activity of the capillary circulation diminished, and the nervous power depressed. Any one familiar with the effects of poultices, kept too long in contact with wounds and opened abscesses, will readily understand their sedative influence. In an opened paronychia, for example, under constant poulticing, the tissues swell and soften, the whole finger is enlarged and acquires a mush-like feel, a fungous mass forces itself out of the incision, and all disposition to heal ceases. The parts are depressed to such a degree that they have not energy enough to take on the reparative process. Substitute a stimulant application for the emollient, and a rapid change for the better is experienced. The same sedative influence is exercised by cataplasms applied on a larger scale. Nor are their effects confined to the seat of their application. On the principle stated in the preceding paragraph, they probably exert an effect, greater or less according to their magnitude, on the general nervous centres. They certainly, I think, operate on certain interior organs in the same manner, or rather with the same effect, as upon the seat of their immediate application. A sympathy seems to connect the interior parts of the body with the portion of surface corresponding to them; so that an impression made on the latter is propagated to the former without change of character. The sedative effect, for example, of water or of cold to the epigastrium, is felt by the stomach itself in a similar manner. Cold has the disadvantage that it drives the blood into the interior by contracting the exterior vessels, and thus in some measure obviates the sympathetic depression of the inner organs by the congestion it occasions. Water is not liable to this objection. Its effects are purely sedative both externally and internally; for the vessels upon which it immediately acts are relaxed, not contracted; and the quantity of the blood in the part, though circulating less rapidly, is not diminished. Hence,

emollient cataplasms are safer sedatives, in cases of over-excitement of the viscera of the chest or abdomen, than cold water, except in the case of hemorrhage, in which the sympathetic constriction of the cold is wanted.

2. *General Indications.*

The indications which water is capable of fulfilling, either topically or generally, externally or internally used, are to relax and soften the skin when dry and constricted; to diminish arterial excitement, whether general or local; to dilute the blood and other liquids within the body, and thus render them less irritating; to allay thirst, and abate abnormal heat by obviating its causes; and to calm nervous irritation, as shown in the relaxation of spasm, the relief of pain, the soothing of general uneasiness and restlessness, and the promotion of sleep by the removal of the causes of wakefulness.

3. *Therapeutic Application.*

The remedial uses of water are very numerous; and, within the limits allowed by the plan of this work, it would be impossible to specify each application, with all the rules requisite for its proper government. I must content myself with considering the subject rather in reference to classes than individual cases.

a. *Inflammation and Vascular Irritation.*

1. *External Inflammation.* In inflammation and vascular irritation, water is of great use as an adjuvant of depletory measures. Applied locally in external complaints, it has the direct effect of diminishing these conditions, and of favouring resolution, unless the affection be of a character, or in a stage, disposed to suppuration; in which case it hastens the latter process. It is employed in all the different modes of external use already described.

In *erysipelatous* and *erythematous* affections, it is very advantageously applied in the form of demulcent liquids, as infusion of slippery-elm bark or flaxseed, applied over the inflamed surface by compresses of soft linen. This is, indeed, I think, the best method of treating complaints of that kind locally. Without at once subverting the inflammatory action, and thus endangering introversion, it alleviates the pain, moderates the excitement, and obviates injurious results. The mucilaginous matter may co-operate in some measure by excluding the air, but the main effect is produced by the water; and, as the liquid soon acquires the temperature of the surface, it is not by any modification of heat or cold that it acts.

In *phlegmonous tumours*, *furuncles*, *glandular swellings*, and *inflamed joints*, after local depletion, when this has been required, water, in the form of emollient cataplasms, is much used; being especially applicable to cases, in which either there is no tendency to suppuration, or it is desirable to promote this condition. When, on the contrary, a disposition to suppurate may be apprehended, and it is desirable that this event may not take place, poultices are contraindicated, and the local use of cold is preferable.

In almost all *cutaneous eruptions*, water acts very happily in diminishing without repelling the affection. It is in the form of warm bath that the remedy is here most efficient; though a local bath might answer where the eruption is local. The bath should be employed daily, or twice a day; and the patient should remain in it long. The only cases to which the remedy is inapplicable are those attended with a very depressed condition of the system, and depraved state of the blood, with a strong tendency to the suppurative or gangrenous condition.

In the *acute exanthematous affections* the bath is less used, because in these the eruption is generally of secondary consideration, and will of itself subside in a short time with the disease; but, whenever there may be an indication for diminishing the cutaneous irritation, and the benefits of the bath may not be overbalanced by its various inconveniences, it may be used with safety and advantage. It is peculiarly applicable to the cases of children. In the desquamative stage of these complaints, the warm bath is often useful in giving softness to the skin, and removing secondary irritations, not unfrequently left behind on the subsidence of the original complaint.

2. *Internal Inflammation.* It is not, however, in the external inflammations only that the local use of water is advantageous. In the phlegmasiæ of the abdominal and thoracic viscera it is often a most useful agent. In those of the chest, much care is required to avoid the partial exposures to cold to which the use of the remedy is incident, and, unless the patient can be well watched, it may perhaps be as well to forego its advantages; but in the abdominal inflammations, and those of the pelvic viscera, it is a most valuable auxiliary to local depletion, or substitute for it when, on any account, inappropriate or impracticable. In these cases, the water may be used in fomentations; but the safest and most effectual method is by large cataplasms, covering the whole of the exterior parts corresponding with the inflamed organ.

Gastritis, *enteritis*, *dysentery*, *peritonitis*, *hepatitis*, *splenitis*, *nephritis*, and *metritis*, are affections calling for this treatment. It is probably

more efficacious when the inflammation affects the membranes than the parenchyma of the organs, and is especially indicated in peritoneal inflammation.

Large poultices applied to the side of the neck and underneath the jaws are useful in *simple angina* and *tonsillitis*, and may be employed with special propriety in these affections occurring in *scarlatina*. Around the neck they are also useful in *laryngitis*, after sufficient depletion.

In all the *acute inflammations* water is also indicated in the form of the *warm bath*, the sedative effects of which are sometimes most happy. The only contraindications are the inconvenience of the remedy in adult cases, and the danger of injurious exposure of the surface to cold during its relaxed state. In infantile cases these objections are much diminished, as children can be more readily guarded from exposure of the surface; and the warm bath is among our most valuable remedies in the infantile phlegmasiæ.

The semicupium or hip-bath is peculiarly beneficial in inflammations and irritations of the urinary and genital organs, including *strangury*, *ischuria*, *amenorrhœa from vascular irritation of the uterus*, and *dysmenorrhœa*.

In certain cases of inflammation or irritation, the free internal use of water proves advantageous upon the principle of dilution. This is particularly true of those cases in which the local affection is either produced or aggravated by the acrid character of the liquid with which it may be in contact. Water here acts not only by its direct sedative influence, but indirectly by diluting and rendering less acrid the irritating material. *Inflammatory affections of the urinary passages* are those in which water acts most beneficially in this way. In such cases it should be taken cold into the stomach, as it is not only more agreeable than when warm, but more likely to pass off by the kidneys.

b. *Idiopathic Fevers.*

The warm bath is in general less advantageous in the *idiopathic fevers* than the phlegmasiæ. Still, it may be occasionally employed with advantage, especially in children, when symptoms of nervous irritation appear, as restlessness, wakefulness, muscular twitchings, and convulsions. In the form of lotion, as by sponging, warm water is frequently used, in order to relax the skin and diminish heat, under circumstances which forbid or render imprudent the external use of cold water; as when the disease may be compli-

cated by visceral inflammation, or there may be some chilliness, or, in parts of the surface, a disposition to perspiration.

In the form of pediluvium, the remedy is often useful, by calming restlessness, promoting sleep, and disposing to diaphoresis.

It is, however, internally that water proves most beneficial in fevers. Here it is used cold; and the temperature has great part in the first favourable effects produced; but the liquid soon acquires the temperature of the body, and is then useful merely as water, by its sedative and diluting qualities.

c. *Nervous Diseases.*

It is in these complaints that water, in the form of the warm bath, shows its remedial powers most advantageously. In most *spasmodic* and *convulsive affections* it is used either as the main remedy, or as an adjuvant. Its relaxing influence gives it peculiar efficacy in these cases. While therapeutically not less applicable probably to adults than to children, it is yet much more frequently employed in the latter, in consequence of the greater facility of its administration. In *croup* it is almost universally employed, more especially in the common or catarrhal variety. In all the different forms of *colic;* in *strangulated hernia;* in *spasm of the stomach, gall-ducts, ureters, bladder, urethra,* and *uterus;* in *cramps of the external muscles;* even in *tetanus,* it may be resorted to with hope of benefit, and often affords great relief if continued sufficiently long. In all *convulsions* of a mere functional character, it is an excellent remedy. In infantile cases it is often the one first thought of, and most efficient. Its calming, soothing, and relaxing influence renders it often highly beneficial in the treatment of *mania,* and the multiplied disorders of *hysteria.* In short, in any case of nervous disorder, of whatever nature or origin, provided it be dependent upon irritation, and not upon debility or depression, the warm bath may be regarded as a suitable measure, when not forbidden by circumstances concerning rather the application of it, than its proper effects.

One caution, however, must always be observed in the employment of this remedy, whether in nervous or inflammatory affections. If there is any existing cerebral congestion, or tendency towards it, too high a temperature should be carefully guarded against, and the water never allowed to be so hot as in any degree to stimulate the circulation, even though for a few minutes. It should, under such circumstances, never feel more than warm to the body of the patient.

III. DEPLETION AS A SEDATIVE AGENT.

By depletion is here meant a diminution, direct or indirect, of the quantity of the blood. A direct diminution is effected by withdrawing a portion of the circulating fluid immediately from the blood-vessels; an indirect, by lessening the quantity of material which supplies its ordinary and necessary waste. I shall consider the subject in these two divisions.

1. *Direct Depletion by Bleeding.*

Direct depletion is accomplished either by the elimination of the liquid parts of the blood through the different secretory functions, or by bleeding. In relation to the former measure, nothing need be said here; as the subject will be fully considered under the several classes of medicines, the special effect of which is to increase the secretions, as the purgatives, diaphoretics, &c. In this place our observations will be confined to bleeding as a direct depletory measure. This is a sedative remedy of vast importance. That it is sedative, follows necessarily the admission of the fact, that it is the blood which, by its excitant and nutrient qualities, supports all the functions, and without which they must all instantaneously fail. It would seem, moreover, to follow no less necessarily that it is a universal sedative. As all the functions are sustained by it, all should be depressed by its diminution. This conclusion of the judgment is true, in fact, whenever a proper balance is maintained in the exercise of the functions; but it will be seen, after a brief examination of the subject, that, under certain circumstances, bleeding is capable of acting indirectly as a powerful excitant; and this must be thoroughly understood before the measure can be employed with due discrimination as a therapeutic agent.

a. *Effects of Bleeding on the System.*

The effects of bleeding are to lessen the quantity of blood for a time, and to impair its quality. The first effect is too obvious to require proof; the second is not so obvious, but not less certain. After the loss of blood, absorption of liquid takes place immediately, in order to supply the deficiency; so that the blood-vessels are soon as full as they were previously to the bleeding. Nature has provided this resource to prevent emptiness of the circulation, and the want of that equable pressure which the blood everywhere exerts, and without which the systemic actions could not be supported in their integrity. But it is not fully elaborated blood that

thus supplies the loss. The vessels take up such liquids as they can find. Water is absorbed from the alimentary canal, and probably from the air; and the various saline and albuminous fluids existing in the system are eagerly appropriated. The water, salts, and albumen lost are, therefore, soon replaced; and the requisite proportion of fibrin is quickly elaborated; but the red corpuscles, which require a longer time, and a more complex process for their development, remain much longer deficient. When the loss of blood has been great, whether from one copious bleeding, or several successive bleedings, this deficiency is very obvious in the paleness of the patient, and the translucency of his tissues; and the anemic condition continues often for a considerable time. Therefore, though the immediate effect of bleeding is to diminish the mass of the blood, the loss in this respect is soon repaired; and the permanent effect is a depreciation of the quality of that fluid, which is rendered more watery, and less able to supply influence and nutriment to the systemic functions.

The immediate phenomena attendant on the loss of blood are a diminution in the fulness and force of the pulse, paleness of the surface, and reduction of the temperature of the body. As the loss proceeds, the pulse becomes more and more feeble, till it can scarcely be felt; the respiratory movements diminish proportionably; the lips, face, and general surface become increasingly pale, and the skin cool; feelings of languor, nausea, muscular weakness, giddiness, mental confusion, and faintness come on; and at last complete syncope takes place, with a temporary suspension of all the obvious vital processes, from which the patient gradually recovers, if the blood ceases to flow.

Syncope. The amount of loss necessary to produce syncope varies exceedingly in different persons in health, and in the same persons in disease, according to the character of the affection, and the special tissue affected. Thus, it is usually much greater in those of sanguine temperament, and the plethoric, than in the nervous and feeble; and in diseases attended with pressure on the brain, acute inflammation, or a sthenic condition of fever, than in asthenic affections with anæmia, or a depraved condition of the blood, as in typhoid fevers. In the former set of diseases more is required, as a general rule, than in health, in the latter less. The loss of blood is usually better borne in the inflammations of the serous and fibrous membranes, than in those of the mucous membranes and the skin. Its degree of effect is often influenced by

idiosyncrasy. Stout and apparently vigorous individuals, in consequence of peculiarity of constitution, sometimes faint under a small bleeding; while others, seemingly feeble, will bear a great loss without the same result. Imagination also is not without influence. I knew a gentleman of stout habit of body, whom the sight of his own blood caused to become extremely faint.

The posture of the body has great effect; that position most resisting syncope, which occasions the greatest pressure on the brain. Hence, much more blood can be taken from a person lying down than sitting, and sitting than standing; and important practical rules are deducible from this fact. It is probable that the greater muscular effort used in the two latter positions may aid in the effect; as, by drawing blood to the muscles, it lessens the force with which it is directed to the head.

The mode in which the blood is drawn has considerable influence; less being required when it is taken rapidly through a large orifice, than when slowly through a small one. The reason of this probably is the sudden diminution of the normal pressure upon the cerebral centres in the former case; while in the latter the diminution is gradual, so that the brain has a better opportunity of accommodating itself to the new circumstances.

"According to Dr. Marshall Hall, the mean loss of blood required to produce symptoms of commencing syncope, in the sitting or erect posture, is, in health, 15 ounces; in congestion of the brain, from 40 to 50 ounces; in inflammation of the serous, synovial, or fibrous membranes, from 30 to 40 ounces; in parenchymatous inflammations, 30 ounces; in mucous and cutaneous inflammations, 16 ounces; while in eruptive fevers it is only from 12 to 14 ounces; in delirium tremens, 10 to 12; in accidents before inflammation has taken place, 8 to 10; and in chlorosis, 8." But these are mere approximations, and liable to great diversity. In relation to the natives of this country, I am quite confident that the 15 ounces, stated by Dr. Hall as the mean in health, is considerably below the actual average.

The syncope from loss of blood is not unfrequently attended with convulsive symptoms; but these, like other nervous disorders, are probably quite as liable to occur from a depressed as from an excited state of the cerebral centres. They do not, therefore, in any degree contradict the idea, that the influence of bleeding is essentially sedative. But certain phenomena do, not unfrequently

occur after the loss of blood, which are clearly the result of abnormal excitement, and which I now propose to explain.

Secondary Excitation. All the functions require, for their due performance, a certain amount of blood of a certain quality. If there be deficiency in either of these respects, they necessarily suffer. To obviate injury from this cause, a relation between all parts of the body and the nervous centres has been established through connecting nerves, of such a nature, that a deficient supply of blood for the functions causes an impression to be conveyed from their seats up to their respective centres, by which the latter are excited into action, and, if the impression be strong, are not unfrequently much disturbed. As a legitimate and intended result of this excitement, an influence is transmitted from the centres to the heart, and probably to the respiratory organs, by which the former is stimulated to increased action, so as to send an additional supply of their essential pabulum to the functions, while by the latter the blood is duly prepared for its office. Now blood, which has been impaired in quality by bleeding, is unable, in the ordinary quantity, to supply the demands of the functions unless they also are proportionably lowered; and consequently, if this should not happen, the heart is stimulated through the nervous centres, to supply, by a greater amount of blood, the deficiency in its quality. But the nervous centres being often over-excited by these demands upon them, act irregularly in the performance of their duties; and consequently signs of nervous disorder are evinced. Hence, in the condition of system induced by bleeding, especially if very copious or frequently repeated, there is often great disturbance of function, which must be regarded as the indirect effects of the loss of blood. Violent palpitation of the heart, excessive frequency of pulse, dyspnœa, headache, neuralgic pains in various parts of the body, wakefulness, sometimes even convulsions and delirium, are among the evidences of this nervous disorder.

But it is important to bear in mind that, in order that this indirect excitement from bleeding should take place, there must be a want of accordance between the performance of the functions and the diminished quality of the blood. If the former continue as in health; if, for example, the patient use as much muscular exertion, eat as much, think as much, even feel as much as under ordinary circumstances, the above symptoms must be experienced in a degree proportionate to the impoverishment of the blood; and, if the functions are called into unusual activity, whether by the will or

other cause; if the patient run, ascend heights, lift heavy burthens, attempt to think deeply, or exert his mind strongly in any way, or be thrown into strong emotion by any cause, the deficiency in the supply of blood is of course more strongly felt, a more powerfully irritant influence is sent to the nervous centres; and the disorders, consequent on their disturbance, are often experienced to an extreme, and sometimes alarming, or even fatal extent.

If, however, care be taken that the various functions shall be reduced in accordance with the reduced state of the blood; if the patient be kept at rest, the amount of food diminished, the mind made to participate in the repose of the body, and nothing allowed to disturb the calm of the passions, the purely sedative effects of the bleeding will be experienced, without the secondary excitements and disorders above mentioned.

It will be perceived, from this course of reasoning, how important it is, in employing this remedial measure, to take care that its intended effects be not contravened by subsequent disturbing influences. Another highly important practical inference is that, by carrying the remedy too far, we may induce an excitable state of system, which shall render the patient liable to extreme disorder, and especially to excessive action of the heart, ending possibly in serious disease of that organ. One of the greatest dangers of the excessive use of the lancet is the production of hypertrophy and dilatation of the heart; the former resulting, in accordance with a well known physiological law, from a too powerful and incessant exertion of the organ, the latter from a softness and yieldingness of the tissue, consequent on the anemic state of the blood.

Bleeding should very rarely be carried to complete syncope, and never when used simply as an antiphlogistic measure. The subsequent reaction, under the operation of causes above explained, may very much interfere with the ends proposed, and do more harm than the occurrence of syncope can possibly do good. The only circumstance which would justify the urging of the remedy to this extent, in the practice of medicine at least, is the existence of a spasm, as of the glottis for example, which unless relaxed must prove fatal, and which there are no other means at command capable of relaxing. In surgery, the measure has sometimes been resorted to, in order to procure complete relaxation of the muscles in cases of obstinate dislocation, which have resisted all ordinary measures. But since the discovery of etherization, I doubt whether bleeding to syncope can now be required in any case.

b. *Modes of Bleeding.*

The methods of bleeding may be divided into the general and local. The former may be effected by opening a vein, or an artery; the operation being called *venesection* in the former case, and *arteriotomy* in the latter. Before it was known how rapidly the blood makes its round in the circulation, and how almost instantaneously the loss of it is everywhere felt from whatever portion of the circulation it may be drawn, the idea was entertained that, in certain cases, there was special advantage in dividing the temporal artery instead of a vein, and that, when venesection was used, it was advisable to take the blood, in certain cases, from one particular vein, from the jugular vein, for example in one case, or from a vein in the hand, the foot, or the thigh, in another. At present general bleeding is effected almost exclusively by venesection; and one of the veins at the bend of the arm is usually preferred; or, if another is selected, it is so less from any supposed peculiarity of effect, than from mere convenience. I have myself no doubt, that every remedial effect which general bleeding is capable of producing, may be obtained by bleeding from the arm in the ordinary method.

1. *General Bleeding or Venesection.* As to the method of performing this operation, and the various cautions requisite, the reader is referred to works on surgery. The following observations have a bearing only on its effects. The quantity of blood to be taken at one time varies so much, according to the objects to be accomplished, the nature and seat of the disease, and the constitution, age, and sex of the patient, that no precise general rule can be given upon this point. It has before been stated that bleeding should never be carried to absolute syncope, unless in cases of spasm of a highly dangerous character, which could not otherwise be relaxed. In such instances, the patient should be bled sitting or standing, so that the object may be accomplished with the least possible loss of blood, and the opportunity, moreover, afforded of quick restoration, by laying the patient down with his head low; an advantage which would be wanting if he were bled in the horizontal position. In the latter case, there might be some danger that the syncope would prove permanent. In strong local determinations of blood to the head or lungs, threatening cerebral or pulmonary apoplexy, and in violent sthenic inflammation of one of the vital organs involving life in danger, bleeding may be carried to the verge of fainting, but should stop short of it. In general, when this remedy is called

been established with conservative objects; for we naturally resort, in suffering of interior parts, to the corresponding outer surface in the application of means of relief. Of the fact, at any rate, I have not the least doubt, having seen it demonstrated beyond the possibility of disbelief.

In the highest stage of vascular fulness and activity, local bleeding is of little benefit. The blood abstracted is so rapidly supplied, and the distending force of the forward movement so great, that the capillary vessels have not the opportunity for contracting. Under such circumstances, the measure should always be preceded by general bleeding. But, after the fulness of the vessels, and the moving forces of the blood have been thus reduced, or in cases in which there is no considerable general excitement, the loss of blood locally is of very great importance, and will often eradicate an inflammation which has refused to yield entirely to the lancet. In many cases of disease, the indications and the contraindications for bleeding may be so nicely balanced, that it may be difficult to decide between them; as, for example, in low fevers attended with inflammation. Here local bleeding is an invaluable remedy: and I have repeatedly seen the loss of two or three ounces of blood apparently turn the scale favourably between life and death. It happens, fortunately, in such cases, that the loss of a little blood has much greater effect than in sthenic states of the system. I have often found it necessary to take a little blood from the chest in the pneumonia of typhoid fevers, when active stimulation has been necessary to support the cerebral centres; and I have myself been sometimes astonished at the relief thus obtained. It has been before incidentally stated that blood may be taken locally from infants, with advantage, in reference to effects on the system at large; the whole quantity taken being so small that it can be abstracted with sufficient rapidity; and the danger being less of over-bleeding than when the lancet is used.

Local bleeding is effected by simple scarification, or by means of cups or leeches. *Scarification* is not often used, and only under peculiar circumstances; as in conjunctivitis, tonsillitis, sometimes in laryngitis, and in glossitis with great enlargement of the tongue, in which deep incisions are recommended when the swelling threatens suffocation. The two latter methods are those commonly resorted to.

As a general rule, it is better, when cups and leeches are used, to take blood from the immediate neighbourhood of the inflamed

part, than from the inflamed vessels themselves; as the wounds sometimes superadd their own inflammation to that pre-existing, and thus endanger some aggravation of the latter. The quantity of blood to be taken by cups or leeches must depend on the circumstances of each case. In the adult, from three to six ounces are usually drawn: but the quantity may be as small as a fluid-ounce, or may amount to twelve or fourteen ounces. In severe meningeal or peritoneal inflammation, I have repeatedly directed one hundred American leeches, which ought to abstract about a pint, if of good quality and well applied.

Cupping. For the method of performing this process, and an account of the instruments employed, the reader will consult works on minor surgery. It is a very efficient process in many cases of disease, sometimes almost indispensable; and no physician, who cannot command the services of a cupper in his neighbourhood, should be without a set of the instruments, or the skill requisite for using them efficiently. Should this happen, however, and a strong emergency call for the use of them, he may substitute an extemporaneous process, by means of a sharp knife and a few wineglasses or tumblers.

Cupping has the advantage over leeching that it can be more quickly effected; can be more conveniently diffused over an extensive surface, as that of the chest or abdomen for example; affords the means of more precisely measuring the quantity of blood abstracted; and superadds to the depletion, the revulsive influence of the subsequent inflammation. It should be preferred, therefore, when no special indication for the choice of leeches may exist.

Dry cupping is a sort of depletory method, which is admirably adapted to inflammation attending very low states of system. It withdraws the blood temporarily from the circulation, and leaves it to re-enter the vessels, when the local object has been accomplished. Its revulsive influence is also not without its advantages. It may be used very freely in thoracic and abdominal inflammation, when the state of the circulation does not admit of any other mode of depletion; and, conjointly with a few wet cups, operates most happily in many instances.

Leeching. This is preferable to cupping when the pain of the operation is a matter of consequence, as in children and delicate or nervous women; when the parts to be operated on are tender to the touch, as in phlegmonous tumours and glandular swellings; when it is desirable to concentrate the bleeding within as small a

space as possible, as the end of a finger; when the tissue is loose, as in the eyelids, the scrotum, &c.; and when the parts from which it is wished to abstract blood, are inaccessible to cups, as the tongue, the uterus, the vulva, the anus, &c. It should almost always be employed preferably in infants.

Two kinds of leeches are used in this country, the *European*, namely, and the *American;* and it is important to discriminate properly between them; as the amount of blood they draw is very different, and disagreeable effects sometimes result from the one, to which the other is much less incident. Without intending to give a description of these animals, for which the reader is referred to the U. S. Dispensatory, I will merely state that the two species may be distinguished by the colour of the belly, which, in the European, is greenish, or greenish-yellow with black spots, in the American, so far as I have ever seen, is reddish-brown. The European leech makes a deeper incision than the American, draws more blood directly, and causes the loss of a much larger quantity from the bite. In consequence of this tendency to hemorrhage, it is impossible to regulate, with an approach to precision, the amount of blood that will be lost. Sometimes, too, it is difficult to check the hemorrhage; and, in several instances, infants have perished from this cause. The average quantity of blood drawn by the leeches imported into this country exceeds, as I have been informed, half an ounce for each leech, including the subsequent bleeding. The American leech is less liable to these disadvantages. Secondary hemorrhage is seldom considerable; the quantity of blood they are likely to take can, therefore, be more accurately estimated; and they are very seldom if ever dangerous. Each animal draws somewhat more than a fluidrachm of blood on the average, and leechers generally estimate two fluidounces to the dozen. Both kinds, however, are uncertain; as the quantity taken varies not only with the state of the worms, but also with that of the part to which they are applied; highly vascular tissues, and those in which the vessels are congested through irritation or inflammation, bleeding much more freely than those in the opposite condition. On the whole, I generally prefer the American leech, and always for infants. The bleeding from the bites of these animals may almost always be arrested by pressure. When this cannot be conveniently applied with any considerable force, I have found the bleeding invariably checked by a small piece of raw cotton, thoroughly wetted with a saturated solution of alum in hot water, just before

the solution has begun to crystallize on cooling, and then pressed upon the wound, so that some of the liquid may enter it.

c. *Indications and Contraindications of Bleeding.*

The indications which bleeding is calculated to fulfil, are 1. to lessen the quantity of the blood when in excess, 2. to lower its quality when abnormally rich or stimulant, 3. to relieve vascular irritation and inflammation through the two agencies just mentioned, 4. to obviate local determinations of blood dependent on excessive action of the heart, 5. to relax spasm and relieve nervous irritation in general by directly depressing the nervous centres, 6. to awaken the susceptibility in any organ rendered insensible by active congestion of the nervous centres, and 7. to promote absorption by depleting from the bloodvessels. It is *contraindicated* in general debility; a scanty, anemic, or depraved condition of the blood; nervous irritations of all kinds dependent on direct depression or debility of the nervous centres; and pure or predominant dilatation of the heart.

d. *Therapeutic Application.*

There is no remedy more important than this; perhaps none which so frequently saves life. That it is susceptible of abuse, and often has been greatly abused, there can be no doubt; but this is only an argument in favour of a careful study of its powers for good and evil, and of great watchfulness in its use; none for its abandonment altogether; and the practitioners who reject it, and oppose their own prejudices or fears against the experience of all ages, not only deprive themselves of a most important agent for good, but assume a responsibility which might well make a conscientious individual shudder. Though never one of those who might be considered as special advocates of the lancet, I fear that, in the reaction from a too indiscriminate, and sometimes reckless use of it, the profession is now in danger of erring in an opposite direction, and cannot but think that the general tendency is rather to an injurious neglect, than to an injudicious use of the remedy. In my experience as a hospital physician, I see many patients past all hopes of cure, whom early and judicious bleeding would probably have saved; but very seldom one, in whom I have reason to think that an abuse of the remedy has been productive of serious injury. It will be impossible in this place to specify every case in which bleeding may be advantageously resorted to. My object, in the following remarks, will be to suggest principles, and give illustrative examples, which may enable the student to decide

for himself, as to the propriety of using the remedy, in any particular case that may come under his notice.

1. *Inflammations.* As an antiphlogistic measure, the loss of blood holds a position far above any other agent; and it is in this capacity, moreover, that it exercises the most beneficial therapeutic influence. It may be said to be always indicated in the earlier stages of inflammation, and, indeed, to a greater or less extent, throughout the process, so long as it is attended with an excess of vascular action; and should be abstained from only upon the grounds, that the affection may be so mild as not to require it, or that there may be a coexisting state of system which may afford indications against it, stronger than those of the inflammation itself in its favour.

In inflammation there is an excess of blood in the affected part, sustaining and augmenting the irritation which first called it thither; there is an exalted or irritated state of the nervous constituent of the tissue; and there is frequently an abnormally excitant condition of the blood itself. To lessen the quantity of blood in the part, to diminish the stimulant quality of that blood, and to lower the nervous exaltation of the inflamed tissue, are the obvious indications. Nothing meets these so efficaciously as bleeding. In relation to the first indication, not only does it lessen the whole mass, and consequently thus far proportionably the quantity entering the inflamed part, but it diminishes the force with which the heart propels the blood, and thus meets the same end by lessening the rapidity of the current. As before explained, it has a powerful agency in diluting the blood, and consequently diminishing its stimulant properties, thus fulfilling the second of the indications mentioned. Lastly, by its direct sedative influence on the nervous centres, it lessens nervous irritation of the part, and meets the third and only remaining indication. No substance is equally efficient for all these purposes; and experience constantly offers its results in proof of the correctness of the reasoning.

But so powerful an agent must not be used indiscriminately. Many cases of inflammation are so slight as not to require this or any other remedy; and many yield to milder measures, as to saline purgatives, low diet, &c., so that it may with propriety be dispensed with. But it should be omitted in no case in which the disease is so severe as to threaten serious consequences, or so situated as to occasion reasonable apprehensions of danger on this score. Thus, we may omit bleeding in inflammations of the tonsils of a degree

of violence in which it would be all important to employ it, were the affection seated in the meninges of the brain, or in the peritoneum.

It is commonly within the first three days after an attack of inflammation that general bleeding should be used. If the case has been under our care from the commencement, we can generally, within that time, do all that is required in this way. One single full bleeding, pushed until the pulse begins to flag, or the lips to look pale, will very often be all that is required. But not unfrequently a second may be demanded, and sometimes, though rarely, a third. If called to the patient at a somewhat advanced period of the disease, there are few points in practice, upon which it is more difficult to come to a satisfactory conclusion, than in reference to the propriety of general bleeding. The safest rule, I believe, is still to bleed, if the pulse has strength enough to allow it, provided the inflammation has not begun to abate, or suppuration has not taken place. If suppuration has set in, it will seldom be proper to take blood from the arm. The same may be said of that condition in which the patient sweats profusely whenever he sleeps, without showing any special tendency to perspiration when awake. This indicates a degree of debility which forbids depletion by the lancet.

There is a state of inflammation to which it is highly important that attention should be called, in reference to the use of bleeding. In consequence of the extent and extreme violence of the affection, occupying some interior organ or tissue, as the lungs or peritoneum, for example, the blood and nervous force appear to be so concentrated in the diseased part, that all other parts of the system are actually depressed; and, instead of high fever, with a full strong pulse and a hot skin, the patient is often apparently prostrate, with a small pulse, a pale and cool surface, and general collapse. It is of the utmost consequence that this apparent prostration be not mistaken for real debility. The use of stimulant measures instead of the lancet would probably prove fatal; and it is only from the latter remedy that, in some cases, safety can be hoped for. The condition can generally be recognized, if it be remembered that it occurs in the early stage and greatest violence of the inflammation, and is attended with unmistakable signs of a high degree of this affection. When a vein is opened, the blood may at first flow slowly and reluctantly; but the current soon increases, and at length becomes quite as rapid as under ordinary circumstances; while the pulse, instead of being further depressed, is developed under the

operation, and often becomes full and strong. The bleeding should be continued until the pulse again begins to flag, not now under oppression, but from real weakness. In some cases of the kind, the pulse does not rise, and the blood withdrawn seems still further to weaken it. In such a condition, efforts should be made, by means of the hot bath and rubefacients, to call the blood to the surface, and in some measure unload the inflamed part; after which the lancet, if again tried, may be found to succeed most happily. Somewhat analogous is that state of depression of pulse and skin which often attends inflammation of the cerebral substance, and sometimes mucous gastritis; in the former case, depending on a failure of the normal influence from the diseased nervous centre upon the circulation, and in the latter on the depressing influence of the nausea so common in inflammation of the stomach. In both, the lancet should be used irrespective of the pulse, which will generally be found to rise under it.

Bounds must be placed to the quantity of blood taken even when the remedy is most strongly called for. It must be remembered that morbid changes often happen in the course of the disease, which time and a certain amount of energy are required to repair. If the strength is exhausted by bleeding, recklessly employed, there may be danger that the system may be unable to pass through the processes requisite for the restoration of health. The inflammation itself may have been conquered, but the patient may die in the arms of victory. Thus, in pneumonia, there is generally consolidation of large portions of the lungs; in pleurisy often very copious elimination into the cavity of fibrin and serous liquid: and strength must be reserved to accomplish the removal, or proper disposal of these abnormal products. Suppuration and ulceration are often inevitable, as the result of a particular inflammation. When this is ascertained, though bleeding may still be indicated to lessen the amount of the approaching evils, care must be taken to leave the resources of the system so far unimpaired that it may finally surmount them. An example of this we frequently have in dysentery.

In deciding as to the quantity of blood to be taken in any case, from the character of the pulse, we must bear in mind the influence upon it of hypertrophy of the heart, and not be led astray by a strength and fulness which may be owing to this cause, and which often continues, through great debility, almost to the very close of life.

After as much blood has been taken from the arm as may seem

advisable, or in cases in which from the mildness of the disease, the previously debilitated state of the system, or the advanced stage, it may not be considered proper to use the lancet at all, local bleeding may frequently be employed with the happiest effects. It will often completely subvert the inflammation, even after it has resisted copious general depletion.

In some cases of inflammation, even of a dangerous character, the state of general debility, the depraved condition of the blood, or the depressing influence of some poisonous agency upon the system may be such, as wholly to preclude the lancet. This sometimes happens even in cases in which the patient may have been in good health previously to the attack; as in typhous pneumonia, malignant erysipelas, &c. But it is more frequent when the inflammation supervenes upon a low disease, as pneumonia coming on in the advanced stage of enteric or typhoid fever. In such cases as these, local depletion is often of incalculable importance. The inflammation may be just sufficient, if unabated, to destroy the patient, and a slight influence may be sufficient to turn the scale in his favour. Just such an influence is often obtained from the loss of a few ounces of blood from the neighbourhood of the inflamed part, when no other measure will afford it. I have seen this too frequently to permit me to have any doubt upon the point. Cups or leeches should be used in such cases, even though it may be necessary to stimulate internally. As much blood should be taken as the strength will permit; but scarcely any amount is so small as to be incapable of good. One or two fluidounces lost will, I believe, sometimes save life. This is particularly the case in the congestive attacks, resembling pneumonia, coming on in low fevers. The patient will be extremely prostrate, his pulse feeble, his skin cool, his respiration difficult, and his colour venous in consequence of the blood passing unchanged through the lungs, or not passing them in sufficient quantity. After the application of two or three wet cups in such cases, and a few dry ones, I have seen the whole aspect of the patient changed as by a charm. The lungs throw off their weight, the blood circulates through them again, the dark colour of the surface disappears, and the pulse regains some activity; though the conjoint aid of carbonate of ammonia, wine-whey, &c., are necessary to sustain the circulatory and respiratory processes.

In *chronic inflammations*, general bleeding should be used very sparingly. There are now and then cases which permit and even require it; but the quantity taken should be less than in the acute; and, generally speaking, local bleeding is much preferable. This

may often be employed with great advantage, and may be repeated from time to time in the same case.

In all cases of inflammation, the presence of a decided buffy coat upon the blood offers, so far as it goes, a favourable indication for the further use of the lancet; unless there may be reason to think that it may result from an anemic state of the blood. Frequent bleedings often induce this very condition; and great care must be taken not to mistake the buffy coat thus induced for a sign of inflammation, and a proof of the necessity of bleeding. This appearance is owing to an excess of fibrin over the red corpuscles. If these have their normal proportion, then the buffy coat indicates inflammation; if they are very deficient, and the fibrin is thus brought into excess, it offers no such proof, and should not be considered as favouring the use of the lancet.

Excessive bleeding, as before explained, by inducing anæmia, may favour the production of hypertrophy and dilatation of the heart. Now, it may sometimes be a question whether the danger should be incurred, in order to save an organ threatened with serious injury from inflammation. Should the organ be a vital one there can be no doubt as to the proper measure. Life must be saved at present, whatever may be the risk in the future. But where it is of less than vital importance, the question is not so easy of solution. When a young practitioner, I had a case of inflammation of the eye, affecting the anterior chamber, which was one-third filled with an opaque puruloid matter. I had bled the patient as much as I dared to do, but without amending the condition of the eye. I then called in the counsel of one of the most eminent medical men of those times. He advised a constant repetition of the bleeding; and it was carried so far that, at last, the blood came from the arm almost like dirty reddish dish-water; and the coagulum formed was reduced to extremely small dimensions. The eye was saved; and the patient after a time recovered tolerable health, though long suffering from very troublesome palpitations of the heart. Some years afterwards, death suddenly occurred; and though I had no opportunity of making a post-mortem examination, I have little doubt that cardiac disease was the cause. With my present views, I should prefer the risk of the destruction of the eye to that of the greater evil.

2. *Vascular Irritation or Active Congestion.* The same indications exist here as in positive inflammation, of which, indeed, active congestion is often the immediate antecedent, and may be considered as the forming stage. In most cases of this kind, however, the

affection is so slight as not to require the loss of blood, yielding either spontaneously, or to abstinence and a saline cathartic. But there are cases attended with great danger, which require the most prompt and efficient interference; and in such cases bleeding is the most effectual remedy. It often, indeed, affords immediate relief, operating more rapidly than even in established inflammation; as, from its nature, the affection is less fixed and more readily curable. The condition calling for the use of the lancet is such an amount of active congestion as to threaten injury to the organ from pressure, or to endanger hemorrhage; especially in important organs, as the liver, lungs, or brain. In active congestion of the brain, either attended with apoplectic symptoms, or threatening apoplectic effusion, prompt bleeding is very important, carried to any extent which may be required to reduce the force of the pulse. The quantity which it is often necessary to abstract is very large, in consequence of the abnormal pressure made on the cerebral centres. In active congestion of the lungs, moreover, the danger is often imminent of immediate suffocation from effusion of serous fluid or of blood; and the remedy scarcely less imperiously called for. A similar condition of the liver is less dangerous, as the organ admits of great distension without fatal results; and the remark is still more applicable to the spleen; but, in either, there is sometimes a call for the use of the lancet.

Hemorrhages are often nothing more than a result of vascular irritation or active congestion of the bleeding tissue; and, in all such cases, the lancet is indicated when the checking of the hemorrhage is strongly called for, and the state of the pulse permits. In milder cases of the same kind, cupping over the affected organ is all that may be required.

Fevers afford examples of high vascular excitement; but simply for the state of fever bleeding is seldom indicated. The affection when idiopathic is generally a result of some agency which the loss of blood has no power to remove or control, and will continue steadily onward, no matter what amount of blood may be withdrawn, short of a fatal result. The pulse may be diminished in fulness and force, and the general strength may be prostrated; but the fever continues with no abatement of its real violence, though some of its phenomena may be partially suppressed. There are, however, two circumstances which, in febrile affections, render the lancet advisable or necessary. When the fever is symptomatic of a special inflammation or vascular irritation, bleeding is often

called for in reference to the local disease; upon the cessation or abatement of which the fever also ceases or abates. Very often, too, the febrile movement causes, or is attended with local inflammations or determinations of blood, which endanger the safety of some important organ, while, by reacting on the system, they may tend to increase the fever. Here venesection is indicated, precisely as it is in similar affections occurring independently of the fever. Local determinations of the kind referred to are extremely common in fevers, especially to the head, lungs, and stomach; and, when general bleeding may not seem to be required, the application of cups or leeches to the organ affected is often extremely useful. This, then, is the general rule for the employment of bleeding in fevers; namely, that it is to be resorted to not directly for the relief of the fever itself, but for the abatement or cure of any local inflammation, or vascular irritation, which may be either the cause of the fever, an accidental attendant upon it, or an effect.

3. *Nervous Irritation.* When this is dependent on an abnormal vascular excitement of the nervous centres, or is connected with active congestion or inflammation of the part in which the nervous disorder is exhibited, bleeding may generally be employed with good effect; though, as in the conditions before referred to, the violence of the affection may not be such as to require it. All convulsive diseases and painful spasms may be ranked in this category, when connected with either of the conditions referred to. In *eclampsia*, bleeding is often extremely serviceable, and sometimes necessary to save life by controlling cerebral excitement. In *spasm of the vocal glottis*, with irritation of the laryngeal membrane, constituting croup in children, it is often necessary. *Spasms of the heart, stomach, bowels, biliary passages, urine, bladder and uterus*, call for it when associated with a similar state of the tissues in which they are respectively situated. The same may be said of mania, and all other nervous disorders. But great care must be taken not to confound these affections with the very similar ones proceeding from pure nervous irritation, without active congestion or inflammation, or from positive debility or depression of the nervous centres; in which cases tonics and stimulants are required, and not the lancet.

4. *To Arrive Susceptibility in the Cerebral Centres.* In cases of poisoning by one of the stimulating narcotics, as opium or belladonna, the brain is rendered so insensible by the poison, that in

cannot duly feel impressions made upon other organs. It is highly important to evacuate the poison, and sometimes emetics are the only means to which we can have recourse. But, in the state of insensibility referred to, these medicines will often fail to operate. Bleeding is here indicated, if the pulse permit, to diminish the cerebral congestion, and thus for a time restore such a degree of susceptibility, as may enable the brain to feel the impression of the medicine, and send the requisite influence to the parts concerned in the act of vomiting.

5. *To Promote Absorption.* With this object, bleeding has sometimes been used in dropsies; but it is almost never proper, unless in cases in which the dropsy is dependent upon vascular irritation or inflammation of the tissue affected; and, in such cases, it might be indicated independently of the effusion. The existence of the latter may, however, afford an additional inducement to bleeding, when it might not otherwise be deemed necessary. In the dropsy connected with acute inflammatory congestion of the kidneys, as in one of the forms of Bright's disease, the remedy is sometimes very useful. In ordinary dropsies, however, the system is in general so much debilitated, that bleeding could do only harm in the end, however much it might momentarily relieve by favouring the absorption of the effused liquid.

2. *Indirect Depletion.*

By this expression is meant a diminution of the quantity of blood, arising from a diminished supply of nutritive material, calculated to repair the waste incurred in the support of the functions. If the blood is expended in nutrition, respiration, and other vital processes, and receives insufficient supplies through the digestive and absorbent functions, it must suffer a diminution, if not in bulk, at least in the proportion of its solid organic constituents. The same effects are produced upon it as result, in the end, from direct depletion. It becomes less stimulant and nutritive to the functions, which are consequently depressed in the same manner as by the loss of blood, though less rapidly. The remarks, moreover, before made in relation to the frequent nervous irritation, and circulatory and respiratory excitement, resulting from an impoverished state of the blood, and to the principles upon which these effects are produced, are not less applicable to the consequences of indirect than to those of direct depletion. It is unnecessary, therefore, to repeat them in this place.

Indirect depletion is effected in two ways; 1. by removing from the stomach and bowels the nutritious material which may have been swallowed, and in a greater or less degree digested, before it has had the opportunity of being taken up by the lacteals; and 2. by lessening the amount or lowering the quality of the food admitted into the stomach. The first end is attained by means of emetics and cathartics, which are, therefore, doubly depletory: to wit, directly, by promoting secretion from the blood, and indirectly, in the method here referred to. This subject will be treated of under the two classes of medicines mentioned. It is the second method only with which we are concerned at present. In this, there may be entire abstinence from food, or simply a diminution of its quantity, or an alteration of its character; or the two latter conditions may be combined.

1. *Abstinence.* Entire abstinence from food can only be tolerated when the appetite is wanting. If it be attempted, as a sedative measure, when the digestive function is in good order, and the system calls for food, though great prostration may occur, and even death result; yet the symptoms exhibited in the progress of the starvation will be anything else than purely sedative. The wants of the functions call imperiously upon the nervous centres: these express their own suffering by an intense sensation of hunger, while the heart is excited to send the diminishing blood in a more rapid current through the organs; and, if no relief is afforded, both the animal and organic functions are thrown into great disorder, and delirium and low fever not unfrequently precede death. Entire abstinence, therefore, cannot be safely resorted to as a sedative agent, under the circumstances mentioned. But for a day or two, in the early stage of severe inflammation, or high fever, when there is an aversion instead of desire for food, it may be proper to obey the pointing of nature, and to withhold nutriment in every shape, allowing the patient only pure cold water. Longer than this, it will seldom, I think, be proper to persevere in the exclusive method, even though the want of desire for food should continue. The starving plan, in inflammations and fevers, may counteract the very object it is intended to serve. The functions are not quiescent in these affections. They are constantly in exercise, in a greater or less degree, and constantly consuming blood. In the absence of any supply through the digestive organs, the circulation must depend upon the material thrown into it through the absorbents, or entering the venous radicles, derived from the dis-

integration of the tissues. This of course is animal food in a highly concentrated form, and probably not always in the best state of preparation. The blood is thus rendered impure, and becomes irritant; and, instead of a simple sedative effect being experienced, it is probable that the inflammation and the fever are increased. Nutritive matter should, therefore, be supplied, at first of the blandest character and feeblest sustaining power, and afterwards, improved in both these respects, as the disease advances, and the system may more need support.

2. *Diminution Simply of the Quantity of Food.* This is undoubtedly sedative in its tendency, unless the diminution be so great as to excite the reactive influences above explained. In health it may, perhaps, be considered as purely sedative. But, in diseases of excitement, a mere abstraction of a portion of the diet ordinarily used in health, without a change in its character, is not all that the circumstances require. Supposing it to be of the usual mixed character, partly animal and partly vegetable, it will often be found to stimulate the system injuriously even in very small quantity. There is something in the flesh of animals, used as food, that is more than purely nutritious. There is something essentially stimulating to the system, quite independently of any immediate effects on the digestive organs. Even in health this may be observed to a considerable extent. Any one who will count his pulse and observe his feelings after a meat dinner, will find the former more frequent, and the latter in various ways evincive of a higher excitation, than when the meal is confined to vegetables or even milk. I have often noticed this in my own personal experience. In diseases of excitement the difference is still greater. How often is the attention of the physician arrested, in his visits, by some aggravation of inflammation or fever, which he is enabled to trace, by his inquiries, to the forbidden use of animal food! Even a small quantity, quite insufficient, by its mere nutritive matter, to produce any sensible impression, will be found sufficient to increase the frequency of pulse and heat of skin, as though the patient had been taking wine. How much more stimulant, for example, is a little soup, than an equal quantity of gruel, though the latter may contain a larger amount of assimilable matter! In employing diet, therefore, as a sedative agent in disease, it is necessary not merely to lessen the quantity, but to abstract from it the animal ingredients, either wholly or in part, according to the degree of sedative influence required.

3. *Low Diet.—Antiphlogistic Diet.* Three conditions are essential to the constitution of a strictly low diet, adapted for full antiphlogistic effect; *first*, that it must be feebly nutritive; *secondly*, that it must not have the effect, through its difficult solubility in the stomach, or any other quality, of irritating the digestive organs; and *thirdly*, that it should not be stimulating to the system. In relation to the first of these conditions, there should be a scale rising from the lowest point nearly up to the standard of health, in order that it may accord with the varying degree of systemic excitement; in relation to the second, the character of the food may be changed with the increasing digestive power; but, so long as a positively sedative influence is required there must be no relaxation upon the third point. For the sake of convenience, we may make four degrees of low diet, rising successively from the lowest; though in reality they run together by insensible gradations.

a. The diet lowest in the scale of nutrition consists of a set of vegetable principles, not analogous in composition to any one of the proper constituents of the animal tissues, and therefore requiring change before they can enter into the nutrition of the body. They are, moreover, very bland in their nature, so as to admit of contact with the irritated tissues, without in general aggravating, in any degree, the existing irritation. They can be readily isolated, and therefore administered without admixture of substances which may be less mild. In watery solution, they are admirably adapted to the highest state of inflammatory and febrile excitement, and should be the first substances used upon commencing a nutritive plan after entire abstinence. The substances referred to are the different kinds of gum or mucilage, starch, and sugar. In composition they resemble one another closely, consisting of carbon, hydrogen, and oxygen, of which the two latter principles are in the same proportion as in water. They differ somewhat in their degree of blandness; gum being first in this respect, then starch, and lastly sugar. The blandest are best adapted to the highest grades of gastric irritation. I shall have occasion to notice these substances more particularly when treating of the class of demulcents. Those most used in this country are gum arabic, infusions of slippery elm bark and sassafras pith, arrowroot, sago, tapioca, barley-water, rice-water, refined sugar, and molasses. They are given in solution, and more or less concentrated, according to the amount of nutrition required. They may be administered separately or mixed, and may often be advantageously flavoured with one of the milder vegetable acids, especially

citric acid in the form of lemon-juice. These acids themselves undergo digestion, and probably, like the principles mentioned, contribute somewhat to nutrition, or to the purposes of respiration; while, by their sedative or refrigerant properties, they directly meet the existing indication. They are occasionally, however, somewhat irritant to the stomach, and require attention on this point. They exist in fruits, from which they are usually prepared for use, in the form of expressed juice, infusion, jelly, or syrup; as in lemonade, orangeade, infusion of tamarinds, apple-water, currant-jelly or blackberry jelly diffused in water, &c. In the same state of system, patients may be allowed to suck the juice of sweet oranges, and the finer kinds of grapes, which are often extremely grateful.

Some chemical physiologists deny the possession of nutritive properties by the above substances, maintaining that they are of use simply by furnishing materials for combustion in the body, and thus supporting animal temperature. Their conclusions are mainly theoretical; but have been supported by the asserted fact, that animals, confined exclusively to one of these principles, die in the course of four or five weeks. But this is true of any other single principle, however nutritious, with the exception, as it is asserted, of gluten. Fibrin, albumen, or gelatin, if given separately and exclusively to dogs, will not support life long. Hence, it is not the want of nutritious properties in gum, starch, and sugar, which causes animals to perish if confined to any one of them, but the fact that a mixture of principles, with the exception above referred to, is necessary to life. Besides, the fact that animals will live a month or more on one of them shows that it has some degree of nutritive property. It is said that they contain no nitrogen, and therefore cannot be converted into nitrogenous tissue. The answer to this is extremely obvious. Nitrogen is supplied by other bodies at the same time; and it is not impossible that, in the digestive laboratory, the nitrogen always taken into the stomach in small proportion in the water drank, and a portion of that inhaled into the lungs, may be made use of to supply the deficiency. There is no satisfactory proof that what is here suggested does not take place; and probability is altogether in its favour. Philosophers, speculating in their closets, are apt to look at the small facts brought immediately before their notice in experiments, and do not sufficiently look abroad at the great facts presented to them in nature. Now, in respect to starch, we are told that, in the shape of sago, it

serves as the chief nutriment for whole tribes of people in the East India Islands; and the fact is notorious, that many millions of the inhabitants of the tropics live almost exclusively on rice, of which 85 per cent. is starch. Now in these hot regions, little animal temperature is required to be generated; as the heat of the climate is often greater than that of the body. If starch, therefore, is intended only to serve the purpose of generating heat in the body, it must be in these countries very nearly superfluous; and yet it constitutes 85 per cent. of the food of the people. Is it possible that nations would adopt, as their main article of diet, a product of which so large a proportion is superfluous? To my mind it seems quite clear, that the starch in rice enters into the constitution of the body, and aids in the formation even of its nitrogenous ingredients; and until the possibility of this fact is disproved, a sound induction seems to me to require its admission. Besides, we have analogous facts in relation to the other principles. The Africans, when they collect gum arabic for commerce, are said to form of it a prominent article of diet, and to be well nourished under its use; and the negroes of the sugar plantations are asserted to grow fat upon the saccharine matter which they consume, at the period of the sugar harvest. At all events, long experience has convinced the medical world, that patients in febrile and inflammatory diseases are sufficiently supported by these mucilaginous, amylaceous, and saccharine drinks, during the highest stage of excitement; and they are still used, and probably will continue to be used, whatever speculative opinions may be entertained upon the subject.

b. A diet more nutritious than the preceding, consists of vegetable products, containing, along with one or more of the principles above treated of, others of nitrogenous composition, and supposed to be identical with certain essential constituents of the animal tissues. These are *albumen*, *gluten*, and the *vegetable fixed oils*. They are highly nutritious without being stimulant, and are consequently well adapted to that stage of inflammation and fever, in which the strength begins to decline, but a degree of excitement continues requiring antiphlogistic regimen. These principles are never used in an isolated state, but combined with gum, starch, sugar, &c., as they exist in nature in the different grains. *Gruel made of Indian meal* or *oatmeal*, *Indian mush*, *boiled rice*, *panada made from wheat bread*, *toasted wheat bread*, and *water crackers*, are forms in which these substances may be used.

In nature, the two sets of nutritious principles above treated of

are often associated with an indigestible principle called lignin or woody fibre, which appears to answer the purpose of stimulating the peristaltic movement of the bowels, and thus obviating costiveness. This frequently gives a fibrous and tenacious quality to the products in which it is contained, rendering them difficult of solution in the gastric juice, and consequently liable to irritate a delicate stomach. On this account, the products alluded to are unfit for febrile cases, in which the digestion is feeble; but, as they are in no degree stimulant to the system, they may be used in mild or chronic inflammation unattended with fever, or deficiency of digestive powers. Such are the *edible fruits*, and the various *garden vegetables*.

c. Next in order of nutritive quality I would place *milk*, which seems, in relation to its qualities as an article of diet, to hold a place between vegetable food, and the more nutritious and stimulating animal products. Its prominent constituent, called casein, is a nitrogenous principle analogous in composition to the vegetable albuminous substances, though, as I believe, somewhat more readily assimilable, and more supporting. The oily matter, too, which it contains suspended in water, through the instrumentality of the casein, is both readily digested and highly nutritious. As infants, and the young of many animals are supported for a long time wholly on milk, it follows that it contains everything requisite for the formation of the body, and may be given in cases requiring nourishment with an entire confidence that it will fully answer the purpose. It is an excellent article of food in cases in which it is still necessary to withhold the full ordinary diet, but an indication exists for improving the blood. I am very much in the habit of using it in low fevers, after the first stage is passed; in enteric or typhoid fever, for example, in the second week. In these cases, I prescribe it in doses of a tablespoonful every hour, which alone, or with a little gruel two or three times a day, or a piece of dry toast and a cup of tea morning and evening, is often sufficient for the nourishment of the patient at this period; before decided debility or prostration has set in, requiring stimulation. In other febrile cases, under similar circumstances, and in inflammations when it becomes desirable to support the strength, I use the same method. This administration of the milk in small quantities, frequently repeated, is often essential to its proper digestion in a feeble stomach. When taken largely, it is apt to be coagulated in a large clot, which the gastric juice cannot readily penetrate, and which, lying heavily

on the stomach, sometimes provokes vomiting. Given in the way I have mentioned, it is readily dissolved, and never aggregates into large homogeneous masses. I consider milk also as preferable to almost any other kind of food, when, in cases requiring a slight reduction of the diet from the ordinary standard of health, there is also evidence of depraved blood. By administering pure milk in such cases, along with remedies calculated to correct the disordered digestive and assimilative processes, we are at least sure of having all the materials necessary for making sound wholesome blood.

d. There is one other modification of food which may be classed with sedative agencies; because, though highly nutritious, it is considerably less stimulating than an ordinary full diet, and may be employed where a slightly depressing influence is required; as in chronic inflammations with a certain degree of debility, which forbids any considerable curtailment of nutrition. I refer to *boiled meats*, including the *flesh of birds*, and *fish*. These are destitute of the more stimulant and soluble ingredients of flesh, and consist mainly of coagulated albumen and fibrin. The former is the chief constituent of the serum of the blood, the latter of the muscular fibre; and both consequently exist in flesh, which always contains blood. They are closely analogous to the albumen and gluten of vegetables; and by most chemists are considered identical. The physician, deciding from his observation of the comparative effects of boiled meats and bread in disease, would entertain some doubt of the entire accuracy of these results. I do not, myself, believe in their identity. I cannot think that the albumen circulating with the blood, and the fibrin of the muscles, are exactly the same as the albumen and gluten of wheat flour. I am quite sure that a diet of the former would be found to be less adapted to inflammatory cases than one of the latter; and that bread might be allowed in fevers where boiled meats could not be prudently given. The casein of milk is placed in the same category with albumen and fibrin; and the three, whether found in animals or vegetables, are supposed to be modifications of a peculiar principle called protein; and hence have been denominated protein compounds. But this view is hypothetical, and would, I think, be quite premature if applied to therapeutics. The probability is that all of them, when taken into the stomach, undergo modifications through the influence of the gastric juice, preparatory to being taken up by the lacteals. The point upon which I would particularly insist is, that the animal products should not, in consequence of close analogy

in composition with the vegetable, be considered as identical in physiological properties, and therefore employed indiscriminately as articles of diet in disease. The vegetable are calculated for a higher grade of inflammatory action than the animal; and the latter hold a position in the scale of diet but a little lower than that adapted to full health. I am not confident that meats thoroughly boiled, so as to be deprived of all their soluble parts, would be entitled to a higher place than milk; but I have no doubt that, imperfectly deprived of their soluble matter, as they generally are when boiled for the table, they are decidedly more stimulating. Soups, oysters, soft boiled eggs, and roasted and boiled meats, though good articles of diet when the object is to stimulate and support an enfeebled system, cannot be admitted among sedative agents; and all stimulant drinks, and condiments are of course excluded.

CLASS I.

ARTERIAL SEDATIVES.

Refrigerants.

THESE are medicines which reduce the force of the circulation by an immediate influence, independently of any depletion they may occasion, and without any obvious direct action on the nervous system of animal life. Whatever effects they may produce upon the brain, considered as the centre of the animal functions, are probably the result of their primary action upon the great organic functions, especially those of circulation and respiration.

It does not follow, from the possession of this depressing power over the circulation, that they are also sedative in their local operation. On the contrary, some of them are energetic local irritants, as the preparations of antimony, for example; and most of them conjoin with their general sedative property that of stimulating one or more of the secretions.

Their influence on the circulation is exhibited in a diminution of the force, fulness, and frequency of the pulse, and of the temperature of the body. From the latter effect, they are frequently denominated *refrigerants*. Under certain circumstances, some of them produce coolness by a direct chemical influence; as when nitre is swallowed in the state of powder, and renders latent a portion of the free heat of the stomach in the act of solution; but generally their refrigerant effect is probably dependent exclusively on the diminished energy of the circulation, and the consequently smaller amount of change in the blood that takes place in the pulmonary and systemic capillaries.

The respiration is depressed correspondingly with the circulation, and probably as a consequence of the diminished amount of blood sent through the lungs.

How far the directly depressing effects of these medicines might be carried by an increase of the quantity taken, it is not easy to determine; as, by their evacuant and locally stimulant properties, the more energetic of them superadd an exhausting depletion, and a violent inflammatory or irritant effect in the part to which they

may be applied, to their immediate sedative influence; but, whether from their depressing effects alone, or from these conjoined with the local results referred to, many of them are capable of destroying life.

When continued long, in regular medicinal doses, they act injuriously on the health by enfeebling all the functions, through the diminished supply of blood. Indigestion, anæmia, emaciation, and general debility result; and, though it might be difficult to adduce instances in which they have directly produced death in this way, yet there can be no doubt that they may operate fatally by incapacitating the system for resisting ordinary diseases.

The arterial sedatives are applicable to the treatment of all diseases in which there is an excess of arterial excitement, and at the same time a sthenic state of the system. Hence they are much employed in inflammation, high vascular irritation, and fever of vigorous action. They may often too be employed to diminish febrile heat and vascular excitement, even when the vital forces are enfeebled and the blood impaired, as in typhoid diseases; but, under these circumstances, more caution should be used, and those medicines of the class should be selected which are least depressing, and have least tendency to impair the blood. Thus, the vegetable acids, as the citric in the form of lemon-juice, and the neutral alkaline salts, as citrate of potassa in the form of neutral mixture or effervescing draught, may be given when the antimonials might be contraindicated.

I. ANTIMONY.

ANTIMONIUM.

The preparations of this metal are, beyond all comparison, the most important of the arterial sedatives. Brought into notice by Basil Valentine, a German monk of the fifteenth century, to whose unfortunate administration of it to his brother monks it is said to owe its present name (αντι *against*, and μονος *monk*), antimony had for a long time to struggle against a fierce opposition, over which it at length triumphed; and it has now taken a position in the materia medica, not probably so high as its warm advocates would have at one time claimed for it, but certainly far above the rank of mediocrity. The intricate diversity of preparation into which it was

tortured by the ingenuity of chemists, and which was formerly very embarrassing to the student, has happily been reduced, with the progress of pharmacy, within much more reasonable limits; though it is probable that therapeutics would suffer little, if they were still further restricted. Indeed, little use is made at present, at least in the United States, of any other preparation than tartar emetic, which is probably capable of producing all the effects that can be obtained from the metal, while it has the advantage, beyond all other antimonials, of uniformity in composition and effect, and precision of dose. The metal itself, when taken internally in the state of fine powder, often acts promptly and energetically, but with so little certainty that, though formerly used, it is now almost never prescribed. It is only in the soluble state that it can affect the system; and the metal, therefore, before it can operate, must be brought into this condition through chemical reaction with the gastric liquids. It is probably the acid of the gastric juice which produces this effect; and the presence or absence of this, therefore, must determine whether the metal is to be active or inert. There is reason to believe that the oxide of antimony (the teroxide of the chemists) is the form in which alone antimony finds entrance into the system, and that the presence of an acid is necessary to make this effective by rendering it soluble. Now, tartar emetic contains this oxide already in a soluble condition, and has the advantage over the metal itself, and the other forms in which it is used, that it can act without the intervention of an acid, and that consequently it does not depend on any fortuitous condition of the stomach, whether the salt shall or shall not affect the system. The preparations of antimony now in use are, 1. tartrate of antimony and potassa, or tartar emetic; 2. the oxysulphuret, under the names of precipitated sulphuret, kermes mineral, and golden sulphur of antimony; and 3. the teroxide, in the form of antimonial powder. I shall treat of the general effects of antimony under the head of the first of these preparations, which may be considered as representing the metal, and shall afterwards allude to what there may be peculiar in the others, whether in their active remedial properties, or the purposes to which they are applied.

1. TARTRATE OF ANTIMONY AND POTASSA.—ANTIMONII ET POTASSÆ TARTRAS. *U. S.*—ANTIMONII POTASSIO-TARTRAS. *Lond.*—ANTIMONIUM TARTARIZATUM. *Ed., Dub.*—*Tartarized Antimony.*—*Tartar Emetic.*

This is prepared by saturating the excess of tartaric acid in the bitartrate of potassa with oxide of antimony. I would here observe that, in using the term oxide of antimony instead of the chemical name of teroxide, I am incurring no risk of being misunderstood, as this is the only well-defined oxide of the metal; the compounds containing larger proportions of oxygen being acids, and called antimonious and antimonic acid. In different processes, different forms of the oxide are used; but it is generally admitted, at present, that the most convenient is the *powder of Algaroth*, which contains the oxide of antimony combined with a little chloride. This is procured by treating sulphuret of antimony (tersulphuret) with muriatic acid, and pouring the solution into water, which precipitates it in the form of a white powder. The reaction between the muriatic acid and sulphuret produces sulphuretted hydrogen, which escapes, and chloride of antimony, which remains in solution. When thrown into water, the greater portion of the chloride gives its chlorine to the hydrogen of the water to form muriatic acid, while the antimony takes the oxygen of the water to form the oxide, with which the undecomposed chloride then combines to form the insoluble oxychloride, or powder of Algaroth. This is boiled with bitartrate of potassa in distilled water, and the solution, having been filtered while hot, is set aside to crystallize. The crystals thus obtained are the salt in question, containing two equivalents of tartaric acid, one of potassa, and one of oxide of antimony, besides water of crystallization. These constituents are probably combined in the form of a double salt, composed of one equivalent of tartrate of antimony, one of tartrate of potassa, and two or three of water. With this view of its nature, it is properly designated as tartrate of antimony and potassa. It should always be procured in the form of crystals, as the possibility of accidental admixture of impurities, or purposed sophistication, is thus provided against; and arsenic, which is stated by Serullas to accompany antimony in its other preparations, is entirely excluded from this, being left behind when it crystallizes.

Properties. The crystals of tartar emetic, when recently prepared, are transparent, but on exposure become white and opaque by efflorescence. Their characteristic form is that of rhombic octohedra,

though, as usually existing in commerce, the crystals are seldom perfect, presenting in general the form of a four-sided pyramid with a broken irregular base. The salt is commonly in the form of a white powder in the shops. Tartar emetic is inodorous, of a slightly sweetish, somewhat styptic, and metallic taste, readily soluble in water, and soluble in dilute alcohol, but insoluble in alcohol when concentrated. Its aqueous solution is decomposed on exposure to the air, with the production of a microscopic fungus, which gives it a mouldy appearance.

The salt is charred by heat, with the odour of burning tartaric acid. With sulphuretted hydrogen it forms in solution an orange-red precipitate of sulphuret of antimony, which is dissolved by hot muriatic acid; and the solution thus formed, if poured into water, is decomposed, with the formation of a white powder.

Incompatibles. Sulphuric, nitric, and muriatic acids produce precipitates with the solution, which are soluble in an excess of the acid. Precipitates are also caused by the alkalies and their carbonates, lime-water, chloride of calcium, acetate and subacetate of lead, corrosive chloride of mercury, hydrosulphuric acid and the soluble sulphurets, and the vegetable astringents through their tannic acid.

1. *Effects on the System.*

In general terms, tartar emetic may be said to be sedative to the circulation and respiration, stimulant to most of the secretions, and, in large doses, emetic, and often cathartic.

Given in minute doses, such as produce no observable effect in health, it is thought to modify the system in some unknown way, so as to be serviceable in certain diseases. In other words, it is supposed to act as an alterative.

When given so largely as to occasion obvious effects, its sedative influence is evinced by a diminution in the frequency, force, and fulness of the pulse, in the frequency of respiration, and in the temperature of the surface. If, at the same time, the heart be examined by the ear, it will be found to act less forcibly.

Along with these sedative effects, there is very often an increase of one or more of the secretions; that one of the secretory functions being most affected, towards which circumstances especially direct the agency of the medicine. Thus, when the patient is covered warmly in bed, and warm drinks or diaphoretic medicines are given at the same time, perspiration is specially promoted. If, on the contrary, the surface of the body be kept cool, and cold or

diuretic drinks are exhibited, the action of the medicine is directed to the kidneys, and the urine is sometimes greatly increased. Should the bronchial tubes be in a state of vascular irritation or inflammation, the antimonial has a tendency to increase the mucous secretion, and not unfrequently acts as a very efficient expectorant. In somewhat larger doses than necessary to affect the secretions above mentioned, and sometimes even in the same dose, it operates as a laxative, producing liquid discharges, which may be bilious, mucous, or watery, showing that the secretions of the liver, the intestinal mucous membrane, and possibly the pancreas, are promoted. When it affects the bowels, it is less apt to act upon the skin and kidneys, partly because it is carried out of the system without being absorbed, and partly also because, when any one of the secretions is increased, from any cause, it is apt to be so at the expense of the others. The medicine is said sometimes also to increase the saliva.

Tartar emetic may produce all the above effects without giving rise to nausea; but, from a certain amount of it, which differs extremely under different circumstances, this effect almost always ensues, attended or soon followed by vomiting, which is often violent and repeated. It is, indeed, one of our most efficient emetics, and is among those which are most nauseating. The sensation of nausea, from this as from other causes, is accompanied with certain highly characteristic phenomena, all of which are of a sedative character, and, when they occur, add greatly to the prostration occasioned by the direct sedative action of the medicine. With distressing sensations of sinking or other uneasiness in the epigastrium, there are feelings of great languor and mental depression, muscular relaxation and weakness, shrunken and anxious features, feebleness and irregularity of the pulse, paleness and coolness of the surface, and often copious sweating. It is when tartar emetic nauseates that it is most apt to operate as a diaphoretic, and operates most freely; but it is by no means true that it never produces the latter effect, unless through the instrumentality of the former.

Of the influence of tartar emetic over the secretions, as well as of its nauseating and emetic properties, I shall have occasion to treat more fully hereafter.. It is as an arterial sedative that we are here specially to consider it.

Within a comparatively short period of time, attention has been called to the extraordinary powers which this medicine evinces, when very largely administered, of reducing the circulation, respira-

tion, and temperature, without, under certain circumstances, acting as an emetic, or in any considerable degree even nauseating. It was formerly supposed that, in large doses, tartar emetic must almost certainly nauseate and vomit, and that these effects, instead of diminishing or disappearing upon frequent repetition of the dose, were usually increased. The contrary of this has been ascertained to occur very frequently. Two or three grains of the medicine will generally be sufficient to vomit, and from six to twelve grains almost always; yet Rasori is stated to have given several drachms daily, and several ounces in the course of a single attack of disease, without the occurrence of vomiting, or any considerable purging; and nothing has been more common, within the last few years, than the administration of from twelve grains to a drachm daily, in divided doses of one, two, or three grains, with no effect of the kind after the first day or two. Sometimes, by giving a grain every hour or two, and gradually increasing, the medicine has been augmented to the quantities mentioned without vomiting at all. In general, however, there are at first vomiting and purging, which may continue more or less for twelve hours, a whole day, or at most two or three days, after which the stomach appears to become tolerant, and bears the medicine without suffering, or even inconvenience. In general, tolerance is established on the second day, or earlier. It is true that it has usually been in highly inflammatory diseases that these large quantities have been administered; and it has been thought that the state of system, under these circumstances, might offer a peculiar resistance to the ordinary nauseating influence of the antimonial, not to be expected in health. This is probably the case to some extent. But similar doses have also been given in affections unattended with fever, and with similar results; and the probability is that this peculiarity of action is physiological, and applicable in health as in disease. Nor is it very difficult of explanation. I have before said that, though the state of nausea is very depressing, yet the sedative influence of the antimonial over the circulation may occur independently of this condition. The two may coincide, and the general effect may thus be increased; but they may exist wholly independently of each other. Indeed, the peculiar depressing effects of the antimonial, upon which its therapeutic virtues mainly depend, are often not experienced when it vomits and purges actively, for the very obvious reason that it is either removed from the system, or fails of being absorbed in consequence of the irritated state of the mem-

brane. Now, nausea and vomiting are not dependent on the simple action of the medicine on the stomach. If the connexion between this and the nervous centres be cut off, neither is the sensation of nausea felt, nor the emetic effect experienced. It is, therefore, upon the impression made on the organic nervous centres connected with the stomach, that the medicine depends for its nauseating operation. But, as the nervous centres of animal life rapidly become accustomed to impressions upon them, the same is probably true, though in a less degree, of the organic. The dose of the emetic medicine, which at first produced nausea, has consequently less and less of this effect upon repetition; so that in time, as in the case of the narcotics, it may be carried to an almost unlimited extent, in relation to this effect alone. The positive limits must be determined by the capacity of the living tissue to bear the chemical influence of the medicine, which, in the case of tartar emetic, might, if certain quantities are exceeded, lead to serious organic results. But, while the nervous centres, which are the proper seat of the sense of nausea, and the source whence flow all its peculiar influences, become insensible to the action of the antimonial on the stomach, it still exerts its sedative influence, through absorption, upon the circulation and respiration, which are often greatly reduced. Thus, the pulse may fall in a few days from the natural standard of between seventy and eighty, down to between forty and fifty, and afterwards be long maintained at the lower rate; though M. Trousseau states that it is rarely diminished more than one-fifth or one-quarter of the number of its beats. It is at the same time sensibly weakened. The respiration is lowered even in a greater ratio than the pulse. The same author informs us that he has known it to fall from twenty and twenty-four times in a minute to six. (*Traité de Thérap.*, 4e ed., ii. 699.) It is singular that, under these circumstances of great circulatory and respiratory depression, the mind is wholly unaffected, the muscles retain their strength, and the organic functions, with the exception of the two referred to, appear not to suffer. Thus it is seen that this condition differs, toto cœlo, from that induced by nausea. Sometimes, instead of being reduced regularly, the pulse becomes first irregular and intermittent under the use of the medicine; and I have noticed the same thing in reference to digitalis.

But it is not in all cases that this tolerance of the medicine can be established. Probably, so far as concerns its direct relations with the gastric nervous centre, the result might be uniform; but

in some instances, the susceptibility of the stomach to the irritant influence of the antimonial is such, that vascular irritation if not inflammation of the mucous membrane is induced, which causes nausea, vomiting, and purging through the relation of the membrane itself with the nervous centres, which is not impaired by repetition in the same manner as that between these centres and the medicine. Consequently vomiting and purging are incessantly maintained, and it is not possible to persevere with the large doses without great danger. Again, should these phenomena return after having once disappeared, an irritability of membrane is induced, which renders the further use of the medicine hazardous. It not unfrequently, however, happens that the tolerance is sustained, after having been established, for many days and even for weeks. Rasori supposed that it was diminished, in cases of disease, as convalescence became established; but Dr. Pereira states that, though he has seen the medicine extensively employed, he has never known this supposition to be satisfactorily confirmed. (*Mat. Med.*, 3d ed., p. 697.)

Occasionally, after tartar emetic has been used largely for some time, there is a peculiar effect experieneed in the mouth and fauces; a feeling of tension, with otherwise disagreeable sensations, and a metallic taste; and occasionally also an inflammation of these parts, with redness and pain, and an aphthous eruption on the mucous membrane. Some suppose these effects to result from the irritative action of the medicine, as it comes in contact with the parts affected when swallowed; others ascribe them to its operation through the circulation. But, whatever view may be entertained of the origin of this antimonial stomatitis, it should serve as a warning, as soon as perceived, to cease immediately with the use of the medicine, for fear that a similar susceptibility to be inflamed by it should extend to the stomach and bowels.

It has been already stated that tartar emetic does not evince any signs of a direct action upon the nervous centres of animal life. Sensibility is not affected, and the mind generally remains perfectly clear in the midst of the most violent disturbance of the organic functions. When nausea is not produced, even the command of the will over the muscles is not impaired. Secondarily, however, the proper cerebral functions are often more or less disturbed. In excessive nausea, all mental energy is lost, and the power of voluntary motion greatly diminished; and, in sympathy with the irritated stomach and bowels, the mind is sometimes more or less disordered, and convulsive movements induced.

Local Effects. The local effects of tartar emetic are those of a powerful irritant. This is abundantly proved by its action upon the stomach and bowels already referred to. Applied in powder or concentrated solution to a mucous, ulcerated, or freshly cut surface, or to the skin deprived of the cuticle, it produces speedy and violent inflammation, not unfrequently attended with mortification. Upon the sound skin it operates more slowly, but in the end causes redness and a peculiar painful eruption, consisting of flat pustules, which cover themselves with scabs, and, if the application be continued, are apt to be followed by deep ulceration, and even sloughing. Of this effect of the salt more will be said under the rubefacients.

Poisoning by Tartar Emetic. Though tartar emetic may, by a proper management of the dose, in reference to amount and succession, be given to a very great extent without causing any serious consequences, it is nevertheless capable of acting as a powerful poison, and has frequently caused death. I believe that its fatal effects are to be ascribed mainly, if not exclusively, to its irritant action upon the alimentary mucous membrane, whether that action be direct or indirect; at least I have neither witnessed its poisonous influence, nor seen any well authenticated account of it, in any case, without evidences of high irritation or inflammation of the stomach and bowels; and, when this is avoided by the mode of its administration, enormous quantities have been taken without serious injury. Probably the reason why death has not more frequently resulted from tartar emetic is, that it is so promptly rejected by the stomach, or carried off through the bowels. Magendie found that half an ounce of it might be given to dogs with impunity, if they were allowed to vomit; but if, after it had been swallowed, the œsophagus was tied, from four to eight grains were sufficient to cause death in a few hours. From five to twenty grains, given at one dose, have frequently produced alarming effects in man; and Dr. Beck mentions the case of a child in which fifteen grains caused death in two weeks, preceded by vomiting, purging, and convulsions. Orfila gives the particulars of a case in which forty grains proved fatal; and several others are on record, in which quantities varying from one to three drachms have had the same effect. The symptoms usually resulting from a poisonous dose of tartar emetic are excessive nausea, violent vomiting and purging, spasmodic pains in the stomach and bowels, burning pain in the throat and epigastrium, sometimes a sense of stricture of the

throat aud difficult deglutition, tenesmus, great prostration, faintness, a feeble vanishing pulse, cold or hot skin, painful cramps in the extremities, and occasionally convulsions and delirium before death.

The fatal result seldom takes place under two or three days, and is often much longer protracted. I have myself witnessed two instances of poisoning from this medicine. One occurred in a woman to whom I was called in consultation by an experienced practitioner, under the impression that it was a case of cholera, though no epidemic of that disease was then prevailing. The symptoms very closely resembled those of cholera. She was vomiting and purging a *whitish liquid* without a tinge of bile; the pulse was extremely feeble, the features shrunk, and the skin cold and of a bluish hue, especially in the hands and feet, of which the fingers and toes were of a dark livid or purplish colour; the fingers were shrunk like those of a washer-woman; there were cramps of the extremities; and she complained of severe pains in her stomach and bowels. Upon investigating into the cause of the symptoms, we learned from her that she had taken, I think on the previous day, to use her own language, "a five-penny-bit's worth of tartar emetic." Under the influence of opium, a sinapism to the epigastrium, and moderately supporting measures, she recovered, though the symptoms were in the highest degree alarming. What was the precise quantity of tartar emetic taken I did not learn. The other instance was in an infant child, about a year old. Tartar emetic had been prescribed by the attending physician for an attack of croup, which was relieved; but directions were left with the mother to give small doses of antimonial wine at short intervals, without any warning as to the possible danger, or limitation as to the length of time. When I first saw the child, some days had elapsed from the first administration of the medicine. It was in the last stage of exhaustion, pulseless, cold, pale or purplish, and discharging white liquid stools. Death quickly followed.

It will have been noticed that, in both these cases, the evacuations were whitish. They had the appearance of opaque rice-water; but differed in this respect from the stools of cholera, that they did not on standing separate into a clear liquid above, and a white flocculent precipitate. Tartar emetic is peculiarly hazardous in children; and, though I believe it may always be safely administered, with due caution on the part of the physician, it requires great care and watchfulness. As it destroys mainly by its irritant action on the

alimentary canal, if the dose be not unwarrantably large in the beginning, and the caution be observed to suspend it on the first signs of excessive action, and especially on the appearance of white stools, there is little reason to apprehend danger. Though I have used it much, I have never seen effects approaching to the character of poisonous, in any case in which I have prescribed it.

The appearances after death from tartar emetic are those of inflammation of the mucous membrane of the stomach, sometimes extending into the duodenum, if not further into the bowels.

The treatment is very simple, consisting, if the patient has not freely and frequently vomited, of warm water to wash out the stomach; infusion of green tea, yellow cinchona, or galls to neutralize any remaining portion of the poison, by forming with it an insoluble tannate of antimony; opiates by the stomach, or still better by the rectum, to allay irritation; and the application of a large sinapism to the epigastrium to obviate inflammation. The after-treatment must be conducted on general principles. Wine-whey may possibly be required, in order to support the strength in cases of great prostration; with leeches to the epigastrium, followed by emollient cataplasms, and in the end by a blister, should symptoms of gastritis be obvious.

2. *Mode of Operation.*

There is no doubt that tartar emetic acts locally as an irritant to the part to which it is applied, and may thus prove emetic by a direct influence on the mucous membrane of the stomach; but there is as little doubt that it is often also absorbed, and produces its effects through the circulation. If reliance can be placed on the results obtained by Magendie in his experiments on dogs, it would seem to have a tendency to produce gastric irritation and provoke vomiting and purging, even though not introduced into the stomach; as, for example, when injected into the veins, or into the areolar tissue. It is said to have operated as an emetic when injected into the rectum, and even when applied to the surface of the body. Death is said to have resulted from its external use in a child of two years old. (*Lond. Med. Repos.*, xvi. 357.) I have myself repeatedly found it impossible to continue the external use of tartar emetic, in consequence of the vomiting which it appeared to occasion, and which subsided upon its relinquishment. But such cases are comparatively very rare; and I have known the most violent vomiting to be checked by its application between the shoulders in

cases of spinal tenderness. Other proofs of its absorption, besides those above given, are that it has been detected, after administration by the stomach, in the blood, the urine, and several of the viscera, as the liver and kidneys. It is even believed to be secreted with the milk; and a very important practical inference is to be deduced from the fact; namely, that it should be given with great caution to nursing women. A case is on record in which an infant was attacked with vomiting, in several instances, immediately after taking the breast of a nurse under the influence of tartar emetic. (*Christison on Poisons*, p. 452.) I have myself been witness of a somewhat similar case, even more suggestive of caution. An infant, whom I was in the habit of attending, had an attack of convulsions whenever antimonial wine was given to it on account of catarrh or other cause, consequent, as I believed, upon irritation of the stomach and bowels by the medicine; so that I found it necessary, in its case, to substitute the wine of ipecacuanha, when there was occasion for an expectorant. I was once called to see it in convulsions, having the same character as those induced on previous occasions by the antimonial. On inquiry, I learned that, though none of the medicine had been given to the patient, the mother had taken antimonial wine for a cold, and had afterwards suckled her child. The convulsions were not peculiarly alarming, and subsided after a change of diet.

The peculiar sedative effects of the antimonial on the circulation and respiration are certainly produced through absorption; as they are not apt to occur when vomiting and purging ensue, except in so far as they may result from the mere nauseating influence; while, if the medicine be given so as not to occasion these effects, they are not only induced, but often continue for several days after its use has been suspended. Whether it acts on the heart through the organic nervous centres, or by a direct influence upon the organ itself, or by some deteriorating change produced by it in the blood, has not been determined; but I have little doubt that it has an important influence on the blood itself; as it produces effects in inflammation greater than can be ascribed to a mere reduction in the rapidity and force of the circulation, and much greater than can be obtained from an even more powerful sedative effect on the pulse, resulting from digitalis.

3. *Indications and Contraindications.*

The medicine is *indicated*, whenever there is a call for reducing arterial excitement, and at the same time lowering the quality of

the blood. Through the former of these effects, it promotes absorption, and may, therefore, be employed for removing effused liquids, and for the discussion of indolent swellings. It is *contraindicated* by a depressed condition of the circulation, a depraved state of the blood, and the existence either of positive irritation or inflammation of the stomach and small intestines, or a strong tendency to it. From what I have before said it may be inferred, that tartar emetic is not a medicine which can be carelessly administered with impunity. At a meeting of the College of Physicians of Philadelphia, wishing to elicit the experience of the members present, I inquired what had been the results of their observations upon this point. Several of the members stated that they had been cognizant of fatal results from its abuse. I have no doubt that serious consequences sometimes occur of which we hear nothing; but this is only an argument for caution, not for an abandonment of so valuable an auxiliary and substitute for the lancet.

4. *Therapeutic Application.*

Tartar emetic was first brought into public notice by Mynsicht in 1631. It is at present among the medicines most extensively employed, and fully merits its reputation. As a direct arterial sedative it is used in inflammations, local vascular irritations, and fevers; jointly in the same capacity and as an alterative, in cutaneous and scrofulous affections; and, for the relaxation attendant on its nauseating influence, in paroxysms of nervous excitement or irritation.

1. *Inflammations.* In all cases of acute inflammation, especially when attended with fever, tartar emetic may be advantageously used, with due attention to the contraindications before mentioned. After bleeding, if required, and a thorough purgation, it is probably the most efficient remedy at our command in the earlier stages, when the indications are to diminish the activity of the circulation, and lessen the stimulating quality, or the richness of the blood. When the skin is hot and dry, in such cases, it may be conjoined with one of the refrigerant diaphoretics, as citrate of potassa or nitre; and, when there is a coexisting indication for the mercurial impression, with the latter of these medicines and with calomel, in the form of the *nitrous powders.* (See *Nitrate of Potassa.*) A slight degree of nausea or laxative effect produced by it will not generally interfere with its beneficial operation; but it should be kept within the vomiting point, and should not be permitted to

occasion griping pains, or an irritating diarrhœa. These inconveniences may often be corrected by conjoining it with a little morphia, when this may not be contraindicated; but if it should still act as an irritant, it should be reduced in quantity, or, if necessary, suspended. Should suppuration occur, with a disposition to sweat copiously during sleep, and other evidences of debility, the antimonial should be omitted. From one-twelfth to one-quarter of a grain may be given every hour or two hours during the day; but, as it is generally desirable that the patient should sleep at night, the medicine may be suspended at bedtime, and in its place a combination of opium, ipecacuanha, and calomel administered, when not opposed by some contraindication, or unnecessary from the moderate character of the affection.

It is not as a substitute for depletion, but as an adjuvant, that I would recommend tartar emetic in inflammation. If mainly relied upon, it must, in serious cases, be given much more freely than as above advised. The plan of treating inflammation exclusively by large doses of the antimonials, or of regarding them as the main remedy, though practised upon from time to time ever since the medicine first came into vogue, has never been extensively adopted, or regarded as a distinct antiphlogistic method, until brought into notice, in the year 1800, by *Rasori*, Professor of Clinical Medicine at Milan, and the famous advocate of the *contrastimulant* system of therapeutics. Upon this method of using tartar emetic, I shall dilate directly, merely premising that, as the result of my own observation and experience, I prefer the ordinary antiphlogistic plan of depletion by bleeding and purgatives; the antimonial being employed simply as an adjuvant, or, if as the chief remedy, only in those mild cases which do not require the lancet, and to which moderate doses of the medicine are adequate.

There is scarcely one of the phlegmasiæ, in which this antimonial may not be usefully employed, with the exception of those in which its tendency to irritate the stomach and bowels might prove hurtful. It is, however, especially adapted to the pulmonary inflammations, in which its expectorant property adds to its efficiency. Mild cases of *bronchitis* may be trusted to this remedy, conjoined with demulcents, a saline cathartic, and low diet; and, in the severe cases, it is the best adjuvant of the lancet in the early stage. Later in the disease, it may be usefully associated with the milder stimulant expectorants, as squill and seneka. In *pneumonia* there is probably no remedy, with the exception of blood-letting, more

efficient in the early stages. During the period of high inflammatory excitement, the patient should be kept constantly under its influence, care being taken to restrain it within the vomiting point; not that a little vomiting would prove injurious in itself, but that it unnecessarily incommodes the patient, and might interfere with the continuance of the remedy. In the advanced stage of the disease, should it not show a disposition to yield, I prefer the treatment by calomel and opium, so as to induce a slight mercurial influence; as I believe that it is even more efficacious, and less prostrating than the antimonial. In *pleurisy* the medicine is less useful; as its influence on the bronchial secretion is here of little avail; and the same may be said of it in *pericardial* and *endocardial inflammation*. But in all these pectoral affections, it has the advantage of diminishing the movement of the inflamed organs, and thereby, in some degree, obviating one of the aggravating influences in the disease. The fewer the pulsations and respirations, the less, of course, is the motion of the heart and lungs. It is quite unnecessary to enumerate every particular local inflammation in which the medicine may be usefully employed. I would simply repeat that it is applicable to all, without exception, when attended with a vigorous and accelerated pulse, and not complicated with irritation of stomach and bowels, or a tendency to this condition. In consequence of their frequent association with vomiting, the antimonial is less adapted to *peritonitis*, *hepatitis*, and *nephritis*, than to some other local inflammations. In peritonitis, especially, the chances of evil from the disturbance of the stomach are so great as probably to outweigh any good from the antiphlogistic properties of the medicine; and, on the whole, it might be best not to employ it in that complaint. The same objection exists to its use in *meningitis*, which is often attended with vomiting; but, when this complication does not exist, and the pulse is excited and tolerably strong, it may be used with propriety. To *gastritis* and *enteritis* it is, of course, quite inapplicable. The same might be supposed of *dysentery;* but, as it is probably absorbed before reaching the colon, it would not be liable to irritate that bowel directly; and experience has shown that it is sometimes useful in the febrile forms of this disease. In the earlier stages of *acute rheumatism* with fever, tartar emetic is almost always indicated. To *acute gout* it is less appropriate; and the liability of retrocession to the stomach should, indeed, forbid its use; as it has not, like colchicum, any specially alterative influence over the disease; while, by irritating the sto-

mach, it might make that a centre of afflux to the irritative tendency, and thus cause a hazardous translation.

The Use of Tartar Emetic in Large Doses in Inflammation. The remarks hitherto made refer to the use of tartar emetic in the ordinary doses of from one-twelfth to one-quarter of a grain every hour or two hours. I should not be doing justice to the subject, without directing the attention of the reader to the method introduced by Rasori, and advocated by Laennec and many other eminent physicians, of using it in very large quantities, so as to make a profound impression on the system, and of relying mainly upon this impression for the cure.

When there is no urgency in the case, from four to eight grains may be given during the first period of twenty-four hours, in doses of half a grain or a grain at regular intervals; and this quantity may be gradually increased, as the stomach is found to bear the medicine, up to twelve, or, if required by the severity of the disease, to twenty-four, or even thirty grains, in the same period of time; and the latter quantity has often been greatly exceeded. Should the case, however, be threatening at the commencement, or considerably advanced before coming under treatment, one grain may be given every two hours from the outset, and continued till amendment takes place, with an increase to two or two and a half grains, should the violence of the symptoms require it. Each dose should be given dissolved in a wineglassful of water, or sweetened water, or weak mucilaginous solution. Should severe vomiting be produced, the intervals between the doses may be increased until the stomach becomes reconciled, and then diminished as before. If the bowels are much disturbed, five drops of laudanum may be added to every other dose until the diarrhœa is checked. It is asserted that there are few cases in which the stomach does not become tolerant of the medicine by the second day, even when much disturbed at first. But, should threatening symptoms be produced, with prostration, cramps in the extremities, or white stools, the medicine should be suspended, and measures resorted to for relieving the excessive vomiting and purging. If, after tolerance has been established, the disorder of stomach and bowels should return, the plan of treatment should be abandoned altogether; as the occurrence evinces an irritability of the alimentary canal, which might lead to serious consequences. It is highly important, for the success of the measure, that the diet should be reduced; and, in acute cases, only farinaceous liquids should be

employed, and these not taken very frequently. Indeed, for the first day or two, water alone, or mucilaginous drinks will be sufficient. Acidulous fruits should be avoided. When the febrile symptoms subside, the quantity of the medicine should be diminished; but it should not be suspended abruptly, even upon the supposed commencement of convalescence. Sometimes the symptoms return when the antimonial is too hastily withdrawn. It should be continued, therefore, in gradually diminishing doses, for some time after the fever has disappeared.

It is in *pneumonia* that this method of treatment has been found most efficacious; and, from the testimony in its favour from the highest sources, there can be no doubt that it exercises an extraordinary control over that disease; often curing the most threatening cases without the intervention of any other remedy. Some employ bleeding conjointly: but others consider that this interferes with the efficiency of the antimonial, and avoid it altogether. It is probable that tartar emetic is useful in the disease, not only by reducing the quantity, quality, and motion of the blood, and diminishing respiration, but also by acting revulsively from the lungs towards the alimentary canal, and, as supposed by Laennec, by favouring the absorption of the exuded matters of the consolidated lung. Trousseau does not think that the spontaneous supervention of vomiting and purging in pneumonia should prevent the use of the antimonial, as he has repeatedly found these affections to subside under its use; but an old diarrhœa, upon which the pneumonia has itself supervened, as when this inflammation occurs in the course of typhoid fever, is incompatible with the remedy.

Other inflammations have been treated upon the same principle. In *acute rheumatism*, particularly the articular variety, the remedy sometimes displays great powers, curing the disease very promptly; while in other cases it seems to exercise little control. *Inflammation of the joints with synovial effusion*, whether of rheumatic origin or otherwise, sometimes yields to it very speedily. In *pleurisy* and the *cardiac inflammations*, it has been found useful, but much less efficient than in *pneumonia*. Severe *bronchitis* will sometimes yield to it; and the remedy has been highly recommended in *meningitis*, which, it is asserted, has sometimes been cured by it in two or three days. The same has been said of its efficacy in *phlebitis*.

But, while acknowledging the favourable results obtained by the method of Rasori in pneumonia and other acute inflammations, I am bound to express my own conviction, that the practice is, on the

whole, not to be recommended. The objections to it are various. Whatever may have been said of the safety of the remedy, the simple fact that tartar emetic has repeatedly proved fatal in quantities less than those often employed in this method of treatment, is sufficient to satisfy us that these statements should be received with some allowance. We hear of successful results; but those of a contrary character are probably not always published to the world; and the practitioner himself may be deceived; as it is very easy for the strong advocate of a remedy to see in its fatal effects, especially when occurring through his own instrumentality, only the effects of the disease. A latent gastric or intestinal inflammation might be roused by the excessive doses of the medicine into fatal activity. The violent effects often produced on the alimentary canal, with the attendant prostration, though capable of being checked, if seen at their very commencement, may do irreparable mischief in the absence of the practitioner; and he never can be positively certain that they may not come on at any moment. When the patient is always under watchful superintendence, as in a hospital, there may be little danger; but, in the ordinary course of practice, when the case is necessarily left, in the intervals of the visits of the practitioner, in unskilful hands, death may occur almost without the suspicion of danger; and, as before stated, I myself was once accidentally the witness of such a result; nor did the parents, or, so far as I know, the physician himself, ever suspect the real cause of the fatal issue. It is by no means certain that, independently of the vomiting and purging, the blood may not be fatally disorganized by the immense quantities of the antimonial introduced into it. The prostration thence resulting might readily be mistaken for that of the disease. Nor is this mere conjecture. The late Dr. Peebles, of Petersburg, Va., recorded several cases, in which patients, who had been cured of pneumonia by this method, died soon afterwards of an irrepressible hemorrhage, induced, as he believed, by the state of the blood poisoned by the antimonial. (*Am. Journ. of Med. Sci.*, N.S. xv. 338.) Nor is the remedy at all essential in these enormous doses. The danger is peculiarly great in children; and, though their pectoral inflammations yield to the treatment with a facility corresponding to the greater danger; yet it seems to me that this does not authorize us to incur the hazard of destroying life by the direct instrumentality of the means employed; especially as a moderate use of the remedy will probably answer quite as good, if not a better purpose, in conjunction with other measures. I cannot

think that, under any circumstances, whether in children or adults, admitting the use of the lancet and local bleeding, the plan of excessive antimonialization should be substituted; and, in cases in which the condition of system will not permit depletion, the mercurial treatment, in connexion with opium and ipecacuanha, and blistering, is probably quite as effectual, and certainly much less hazardous; aided, as it may very properly be, by the use of antimonials in safe doses.

Chronic inflammations are often benefited by tartar emetic, though less decisively than the acute. It may be appropriately employed, whenever the state of the system is sthenic, and the action of the heart and arteries above the healthy standard.

2. *Local Vascular Irritation.* In any disease of which this condition constitutes the main feature, tartar emetic may be used, unless some one of the contraindications before enumerated exist. But the special affections which most frequently require it are the *hemorrhages*, dependent on local irritation or active congestion in the part affected, and attended with an excited state of the circulation. These conditions are frequently presented by *hemorrhage of the lungs*, whether *parenchymatous*, or in the form of *hæmoptysis*, in which tartar emetic is often used with a view to repress arterial excitement, and is an admirable adjuvant of the lancet, or substitute for it when forbidden. Under similar circumstances, it may be used in *uterine hemorrhage* and *hæmaturia*, and even in the *hemorrhoidal flux* when febrile in its character; but it is forbidden in *hemorrhage from the stomach* and *small intestines*, in consequence of its local irritant properties; and in active cerebral congestion, or apoplexy, though indicated for its sedative effects, it is somewhat hazardous from its liability to cause vomiting, and thereby occasion pressure on the brain. In all these hemorrhages, it has no direct hæmostatic power, but operates solely by diminishing the congestion upon which the bleeding depends.

3. *Fevers.* In all the *idiopathic fevers*, with a sthenic state of the system, and no gastric or intestinal irritation, or peculiar tendency to it, tartar emetic is very useful by diminishing the febrile excitement, and promoting the secretions, especially that of the skin. It forms in these affections an excellent addition to the neutral mixture or effervescing draught, increasing very greatly the sedative influence of that remedy, while receiving from it a more decided direction to the surface of the body. In the paroxysms or

exacerbations of the *miasmatic fevers, whether intermittent or remittent*, it is often thus associated, with great advantage, whenever the stomach is not irritable. It is less useful in *yellow fever*, in consequence of the very frequent presence of gastric irritation or inflammation, and, upon the whole, is better avoided in that complaint. To *enteric or typhoid fever*, moreover, it is inapplicable from the characteristic intestinal lesion of that disease, which either provokes diarrhœa, or gives a strong tendency to it, and through which the antimonial might occasion exhausting discharges, while aggravating the local affection. It might be supposed also that tartar emetic would be contraindicated in *typhus fever*, in which the state of system is anything but sthenic, and there might be danger from impairing the quality of the blood. Nor have I been in the habit of using it in that complaint, influenced by the views which I entertain of its essentially depressing character, and greatly preferring citrate of potassa as a diaphoretic. Nevertheless, one of the preparations of antimony, either the empirical *James's powder*, or the officinal substitute for it, which, so far as it acts at all, resembles tartar emetic in its influence, has been much used by British practitioners in their indigenous fever, which is usually typhus; and Dr. Graves of Dublin specially recommends the conjoint use of tartar emetic and opium in the intense cerebral excitement, sometimes occurring in the advanced stage of that disease. Of the exanthematous fevers, *measles* offer the strongest indication for the use of this remedy, both from the bronchial inflammation, and the sthenic condition of system, which attend and usually characterize it. The eruptive fever in *smallpox* is often accompanied with vomiting, and the secondary fever with debility, both of which contraindicate tartar emetic; but, under other circumstances, the medicine may be advantageously used in the disease, whenever called for by the frequency of pulse, and increased heat of skin. *Scarlatina* is too often essentially asthenic to justify the use of the antimonials; and the same is also frequently the case with *erysipelas;* though cases of the latter affection of an opposite tendency sometimes occur, in which the medicine may prove beneficial, pushed even to nausea or vomiting.

4. *Cutaneous* and *Scrofulous Diseases.* In all the *cutaneous eruptions* with a febrile and sthenic state of system, the antimonials are indicated for their sedative effects, when no gastro-intestinal irritation complicates the disease. But they are also much used in cases not attended with fever, whether acute or chronic, under the

impression that they exercise an *alterative influence* favourable to the disease. They may be employed in all cases, when the stomach and bowels are not irritable, the blood is in good condition, and no general debility exists. There is no doubt, I think, that they do good in these affections; but it is questionable whether they do so by any other influence than a slight degree of that which renders them so useful in acute inflammations, operating insensibly, through a long period of time.

The same remark is applicable to their use in *scrofulous affections*. It is in the earlier stages of these complaints, before exhausting suppuration has occurred, while the attendant local inflammation is still somewhat active, and some degree of febrile excitement is present, constantly or at times, that the remedy is indicated: and, in this condition, it occasionally seems to be useful in lessening the frequency of pulse and heat of skin, and perhaps in moderating the inflammation. Scrofulous affections of the absorbent glands, the joints, the skin, &c., sometimes offer these indications: and the same may be said of the earlier stage of *phthisis*, when there is often occasion to moderate the excessive frequency of pulse, the intercurrent inflammation of the lungs, bronchia, or pleura, and hemorrhagic excitement; but the medicine is seldom appropriate after the occurrence of hectic, and care should be taken to avoid irritation of the stomach and bowels. Hence it is necessary to use the remedy in very small doses, except under circumstances of temporary excitement, when it may be used more freely for a time. A good method of administering it, when intended for permanent effect, is to dissolve it in the ordinary drinking water, in such proportion as to be quite imperceptible to the taste, and to allow the patient to use it thus habitually for his common drink. For this purpose one-quarter or one-half of a grain may be dissolved in a quart of pure cold water; the whole of which may be taken in twenty-four hours, if required by the thirst of the patient; though care should be taken not to swallow much of it at one time. The same method of administration may be used in other forms of scrofulous disease, and in the *chronic cutaneous eruptions*.

5. *Nervous Irritation.* In nervous diseases there are now and then paroxysms of high excitement, in which tartar emetic proves very useful, by the sedative and relaxing effects which attend its nauseating operation. There is, perhaps, no more efficient method of overcoming the *paroxysmal excitement of mania*; the medicine being given in doses just insufficient to vomit, and repeated at inter-

vals of half an hour or an hour, so as to sustain a degree of nausea, greater or less according to the demands of the case. Usually one-quarter or one-half of a grain will be sufficient for the effect desired; but sometimes it may be necessary to increase the dose. It should be omitted when the immediate occasion ceases, or if it cause vomiting or purging. In the same mode of administration, I have used it very happily in controlling the violent *paroxysms of hysteria*, especially when in the form of frequently recurring convulsions. It has also been recommended, in connexion with opium, in *the violent cerebral excitement* not unfrequently occurring in *delirium tremens*. It is, indeed, among the most efficient remedies in those cases of the disease, in which active meningeal or cerebral congestion, or even inflammation has been excited, under the intense stimulus of a debauch in drinking, and the affection has afterwards become complicated with delirium tremens by a suspension of the stimulant.

Of the local use of tartar emetic as an irritant, we shall have occasion to treat, when on the subject of the rubefacients.

5. *Administration.*

Tartar emetic is almost always best given in solution; and the best solvent, on the whole, is pure water. When suspected of inflaming the mouth and throat in its passage, it may be administered in pill. The dose varies greatly, according to the effects desired. As an *alterative*, from the thirty-second to the twelfth of a grain may be given, and so repeated as to amount to one-quarter or one-half of a grain in twenty-four hours. For its *moderate sedative effects*, and as an *expectorant* and *diaphoretic*, without the complication of nausea, from one-twelfth to one-quarter of a grain should be repeated every hour, two, or three hours. With a view to *the production of nausea*, from one-quarter to half a grain may be administered at intervals of half an hour or an hour. Two or three grains will usually act as an emetic, and sometimes a much smaller quantity, even so low as one-quarter or one-eighth of a grain; but in this case, upon a repetition of the dose, the emetic effect will often cease after a time. When the object is to produce a profound sedative impression, I have already stated that the commencing dose may be half a grain or a grain, to be repeated every two hours, and gradually increased, if required, to two grains, or even two and a half. The sedative effects sometimes continue several days after the suspension of the medicine.

Particular caution and watchfulness are necessary in the use of

tartar emetic in infantile cases; and the physician should never direct its continuous use in a child, without warning the nurse of its possible effects on the stomach and bowels, and directing its discontinuance should these effects come on.

The only officinal preparations of tartar emetic, for internal use, are the following.

ANTIMONIAL WINE.—VINUM ANTIMONII. *U.S.*—VINUM ANTIMONII POTASSIO-TARTRATIS. *Lond.*—VINUM ANTIMONIALE. *Ed.*—ANTIMONII TARTARIZATI LIQUOR. *Dub.*

This is prepared by dissolving tartar emetic in sherry wine, in the proportion of two grains to each fluidounce. Madeira or good teneriffe will answer equally well. The inferior wines, and all those having astringent properties, are unsuitable as a menstruum; because they often contain principles which decompose tartar emetic, and form with it insoluble precipitates. In the case of the red or astringent wines, the tannate of antimony is formed and deposited. The advantage of wine, as a solvent of tartar emetic, is that, through the alcohol it contains, the antimonial is protected against the decomposition which it always undergoes in aqueous solution when kept; while, if the stronger alcoholic liquids were used, the preparation would be rendered too stimulating, if, indeed, the spirituous liquors would dissolve the antimonial without dilution.

Antimonial wine should never be substituted for the aqueous solution, when this can be conveniently obtained, and especially when the pure sedative effect is desired. But, for extemporaneous use, in families, and especially upon occasions where the antimonial may be wanted in haste, the wine answers an excellent purpose. It is also very convenient for the extemporaneous administration of small doses; as the smallest quantity required, even in the youngest infant, may be obtained by dropping it. To adults it is seldom administered, except as an expectorant. For a child a year or two old, with a view to its moderate sedative effects, from two to eight drops may be given for a dose, repeated every hour, two, or three hours; beginning with a small amount, and increasing, if necessary, but, on the occurrence of vomiting or purging, or of symptoms of prostration without these phenomena, immediately diminishing the dose, or omitting the medicine altogether.

Compound Syrup of Squill (SYRUPUS SCILLÆ COMPOSITUS, *U.S.*) contains a grain of tartar emetic in each fluidounce; but, as it is used only as an expectorant or emetic, it will be referred to more particularly in another place.

II. OXYSULPHURET OF ANTIMONY.—ANTIMONII OXYSULPHURETUM.

Three distinct preparations have been introduced into pharmacy, to each of which the above name belongs. All of them consist of sulphuret of antimony combined with oxide of the same metal; and they differ simply in the proportion of their constituents, though the precise amount of this difference has not been determined, probably because it is variable. They are the precipitated sulphuret of antimony, kermes mineral, and golden sulphur of antimony. I shall first treat of them severally, in their chemical and physical relations, and afterwards jointly, in reference to their effects.

I. PRECIPITATED SULPHURET OF ANTIMONY.—ANTIMONII SULPHURETUM PRÆCIPITATUM. *U.S., Dub.*—ANTIMONII OXYSULPHURETUM. *Lond.*—ANTIMONII SULPHURETUM AUREUM. *Ed.*

This is prepared by boiling together powdered sulphuret of antimony and solution of potassa or soda; then filtering, and precipitating with sulphuric acid, while the solution is still hot; and lastly washing the precipitate. A double decomposition takes place between the sulphuret of antimony and potassa (oxide of potassium), by which the oxide of antimony and sulphuret of potassium are formed; a portion of the sulphuret of antimony and of the alkali remaining undecomposed. The oxide of antimony formed, and a portion of the residuary sulphuret of antimony, though insoluble in pure water, are held in solution, the former through the instrumentality of the remaining alkali, and the latter by the sulphuret of potassium produced. The sulphuric acid, by neutralizing the potassa or soda used, and decomposing the sulphuret of potassium, does away with the solvent property of the liquid; and the oxide and sulphuret of antimony consequently fall, being combined together as an oxysulphuret.

Properties. Precipitated sulphuret of antimony is an orange or reddish-brown powder, without smell, tasteless if quite pure, but usually somewhat styptic, and insoluble in water. When heated, it burns; sulphurous acid escaping, and a grayish oxide of the metal being left. Most of the preparation is dissolved by muriatic acid, with the escape of sulphuretted hydrogen; and, if the resulting solution be poured into water, a white precipitate is produced, which is the *powder of Algaroth*, and chemically an oxychloride of antimony. According to Mr. Phillips, the precipitated sulphuret contains, in 100 parts, 76.5 of sulphuret of antimony, 12 of oxide of antimony, and 11.5 of water.

II. KERMES MINERAL.—KERMES MINERALE.

If, in the process for preparing the precipitated sulphuret, the liquor obtained by boiling together sulphuret of antimony and the alkaline solution, be allowed, after filtration, to stand until it becomes cool, without the addition of sulphuric acid, a powder is slowly deposited, which, when washed and dried, is the preparation in question. In this case, the precipitation takes place simply because the oxide and sulphuret of antimony are less soluble in the liquor cold than hot; but, as the oxide is more soluble in the alkaline liquid than the sulphuret, the latter is deposited in larger relative proportion than in the last preparation; and the kermes thus obtained, though an oxysulphuret, yet contains but a small proportion of the oxide.

The French Codex directs it to be made with the carbonate of soda, instead of one of the caustic alkalies; the process being in other respects the same; but, as the carbonate is not capable of holding so much of the oxide in solution when cold as the caustic alkali, more of the oxide is precipitated on cooling. The resulting kermes is, therefore, richer in oxide than as procured by the former method; and, as the efficacy of the preparation depends on the oxide, it is proportionably more efficient.

Properties. Kermes mineral is distinguished from the precipitated sulphuret by its darker colour, which is ordinarily some shade of dark-brown; but it loses its colour by exposure to air and light, and becomes ultimately yellowish-white. Its chemical relations are similar to those of the precipitated sulphuret.

III. GOLDEN SULPHUR OF ANTIMONY.—SULPHUR ANTIMONII AUREUM.

If to the solution remaining after the deposition of kermes, in the first of the two processes above given, sulphuric acid is added, the whole of the oxide and sulphuret remaining in the solution is deposited, constituting the golden sulphur. But the reactions are supposed to be somewhat more complex than as just stated. By a brief exposure to the air, it is supposed that a part of the potassium of the sulphuret of potassium in the solution is oxidized by the atmospheric oxygen, and converted into potassa, while the sulphur liberated combines with the undecomposed part of the sulphuret of potassium to form a more highly sulphurated compound, the excess of sulphur in which, on the addition of sulphuric acid, is deposited along with the oxide and sulphuret, so as to form a sulphurated oxysulphuret of antimony. If the solution used be that left after the precipitation of the kermes in the second process above given,

in which the alkaline carbonate is used, as more of the oxide is deposited with the kermes, less remains to be precipitated by the acid, and consequently less must be contained in the resulting golden sulphur.

Properties. Golden sulphur of antimony is distinguished by its fine golden-yellow colour. Its chemical reactions are the same with those stated as belonging to the precipitated sulphuret.

Effects of the Oxysulphuret of Antimony on the System. There can be little doubt that these preparations of antimony act through the oxide they contain; the sulphuret being probably inert, or nearly so. The precipitated sulphuret, as it necessarily consists, from the mode of its preparation, of all the oxide and sulphuret contained in the two others, may be considered as representing them. In this country and Great Britain, it is the preparation generally used. On the continent of Europe, preference is almost universally given to the kermes. The effects on the system are the same as those of tartar emetic, but less uniform from a particular dose, partly on account of the uncertain proportion of oxide in the preparation, and partly from the fact, that the oxide depends in great measure, if not altogether, for its efficiency, upon the presence of an acid in the stomach, which may separate it from the sulphuret, and render it soluble. But, as time is required for this change to take place in the stomach, the preparation is longer in producing its effects, and produces them more gradually; so that more of the constitutional action of the antimonial, in proportion to the local irritation, might be expected from the oxysulphuret than from the soluble salt. The uncertainty of its operation, however, will always give an advantage over it to the emetic tartar, which has, besides, the recommendation of greater promptitude of action.

Therapeutic Application. Either of these forms of oxysulphuret may be used, with a view to its sedative effect, for the same purposes as tartar emetic. It is sometimes preferably used as an alterative in cutaneous eruptions, chronic rheumatism, chronic glandular swellings, scrofulous affections, secondary syphilis, and chronic diseases of the liver with deficient secretion; in most of which complaints, it may often be usefully associated with calomel or blue pill, or other alterative. When given largely, vegetable acids and acidulous fruits should be abstained from, lest they may give it undue activity. The dose as an alterative is from one to four grains, which may be given at bedtime, or repeated more or less frequently through the day, according to the urgency of the

case. M. Trousseau recommends the kermes strongly for procuring the more powerful sedative effects of the antimonial, for which purpose, from one to two drachms of it may be given to an adult, in divided doses, during twenty-four hours, and, to an infant at the breast, four grains during the same length of time. In the dose of from five to twenty grains, the medicine has been occasionally administered as an emeto-cathartic.

III. OXIDE OF ANTIMONY.—ANTIMONII OXIDUM. *Ed.*, *Dub.*

There are three definite compounds of antimony and oxygen, of which one only is ranked as an oxide, and is capable of acting as a base; the others having acid properties. It is at present generally considered by chemists as a *teroxide;* but I prefer the simple name above given for a medicinal title, as it is sufficiently expressive, and not liable to be mistaken. The compounds with acid properties are denominated respectively antimonious and antimonic acids. Several preparations, at one time officinal, contain oxide of antimony as their prominent ingredient, of which the *powder of Algaroth* or oxychloride is one, and the *antimonial powder* or *compound powder of antimony*, of the British Pharmacopœias, is another. A *purer oxide* may be obtained by washing the powder of Algaroth (see *page* 57) with an alkaline solution, by which the portion of chloride is converted into oxide, or by precipitating tartar emetic by an excess of solution of ammonia. When pure, the *oxide of antimony* is a white powder, becoming yellowish by heat, inodorous, tasteless, and insoluble in water. Exposed to heat, with the access of air, it is converted into antimonious acid by the absorption of oxygen. But the preparation most employed is either the secret empirical compound sold in England under the name of *James's Powder*, or the *antimonial powder* above referred to, which is made in imitation of it.

ANTIMONIAL POWDER.—PULVIS ANTIMONIALIS. *Ed.*, *Dub.*—PULVIS ANTIMONII COMPOSITUS. *Lond.*

This is prepared by heating together sulphuret of antimony and the shavings of hartshorn, or of bones, until the sulphur of the sulphuret, and the organic matters of the horn or bone have been completely dissipated, and there is left a mixture of phosphate of lime from the latter source, and oxidized antimony resulting from the combination of atmospheric oxygen with the metal. But the

degree of oxidation of the antimony is not precise, varying with the shorter or longer continuance, or the degree of heat.

Composition. If properly prepared, the powder should contain a portion of the oxide (teroxide), on which its efficiency chiefly if not exclusively depends: but the greater portion of the antimonial ingredient is in the form of the antimonious acid; and sometimes it is exclusively so, the oxide being entirely wanting. The phosphate of lime is quite inert. A portion analyzed by Dr. Maclagan, of Edinburgh, yielded about 4 per cent. of oxide of antimony, 50 of antimonious acid, 45 of phosphate of lime, and less than 1 of antimonite and of superphosphate of lime, which are the only soluble ingredients.

Properties. Antimonial powder is white, gritty, inodorous, tasteless, and almost wholly insoluble in water, except when it contains a minute proportion of antimonite and superphosphate of lime.

Effects on the System. These are precisely the same as those of tartar emetic, but somewhat more slowly induced, and much more uncertain. As the virtues of the preparation probably depend exclusively on the oxide, which either exists in it in uncertain proportion, or is quite wanting, no dependence can be placed upon any particular parcel of it, unless previously tried, or analyzed before trial, and found to contain the oxide. The inertness of the antimonious acid depends on its insolubility, not only in water, but in the liquids of the stomach, which, when acidulous, are capable of dissolving the oxide. But, as the activity of the oxide depends on the presence of an acid in the stomach, this ingredient is also more or less uncertain. Sometimes a few grains of the powder will operate actively, and even violently; in other instances, no effect is obtained from a drachm; and Dr. Elliotson found 120 grains almost without action. In this extreme uncertainty of the medicine, the preparation should be abandoned, and the purer oxide of antimony substituted, if any form of the oxide is employed.

Therapeutic Application. *James's powder* was formerly much employed in Great Britain in the treatment of fever; and the *antimonial powder*, which was contrived by Dr. Pierson, of London, as a substitute, came into use upon the strength of the reputation of the former preparation. It has been used chiefly as a diaphoretic, or emeto-cathartic, in the treatment of fever and rheumatism; and has sometimes been employed as an alterative in diseases of the skin. The dose is from three to eight grains, repeated every three or four hours, until it proves diaphoretic, or operates on the stomach or bowels. It may be given in pill, bolus, or powder mixed with

syrup. The pure oxide should not be given in a larger commencing dose than a grain, which may be repeated every hour or two, and increased, if necessary, till its effects are obtained.

II. REFRIGERANT SALTS.

Most of the alkaline salts, whether neutral, or with excess of acid, are directly sedative to the circulation, independently of any evacuation they may produce. As a general rule, their sedative influence is not powerful, and is evinced rather by a reduction of temperature, than by any very striking effect upon the pulse. Hence they have been denominated *refrigerants*. Nevertheless, they do reduce the pulse both in frequency and force; and some of them considerably so, especially nitrate of potassa. The probability is that they act through absorption, and, in part at least, directly upon the blood; impairing its quality, and consequently the functions which depend upon it for their due performance. The precise character of the change in the blood will be given, so far as it is known, when the several salts are specially considered. At present, it is sufficient to state that it is of a nature to render that fluid less capable of stimulating the circulation, and of supplying plastic material for nutrition. It is not impossible, however, that these medicines exert also an immediately depressing influence on the heart and blood-vessels, through their relation with the susceptibility of those organs. But all of the refrigerant salts have evacuant properties; some being specially cathartic, others diaphoretic, and others again diuretic; and it is more in reference to these properties, than to their direct sedative power, that they are remedially employed; though, in the choice of evacuant medicines, in any particular case, these are always preferred to others, when there is at the same time an indication to reduce arterial excitement and febrile heat. They will, therefore, be treated of severally in connexion with the classes to which they belong as evacuants. Only one of them, which is employed chiefly as an arterial sedative, though possessed also of the property of stimulating the secretions, will be considered in this place.

NITRATE OF POTASSA.—POTASSÆ NITRAS. *U.S., Lond., Ed., Dub.—Nitre.—Saltpetre.*

Origin. Nitre is at present obtained almost exclusively from the East Indies, where it is extracted from the soil occasionally over-

flowed by the Ganges, and enriched by the animal and vegetable matters washed down by that stream from the vast region which it drains. This earth is impregnated with the nitrates of potassa and lime, and, on being lixiviated in connexion with wood ashes, yields a solution chiefly of the former salt; the lime of the nitrate of lime being replaced, in the process, by the potassa of the ashes. The nitre is then obtained from the solution by evaporation and crystallization. As imported, however, it is very impure, containing, with other foreign substances, a considerable proportion of common salt, from which it must be freed by a carefully conducted process of solution and crystallization before it is fit for use.

The salt may also be artificially prepared by exposing to the air, for a long time, a mixture of animal and vegetable matters, with more or less lime in the shape of refuse mortar, &c., and treating the mass, which now contains nitrates of potassa and lime, by a process analogous to that employed with the earth of the Ganges. (See *U. S. Dispensatory.*)

Properties. Nitre crystallizes in long, white, semitransparent, striated, six-sided prisms, with dihedral summits. It is inodorous, of a sharp, saline, somewhat cooling taste, very soluble in water hot or cold, but more so in the former, and insoluble in pure alcohol. It contains no water of crystallization, and is permanent in the air. Thrown into the fire, it decrepitates, in consequence of the rapid evaporation of water contained mechanically between the laminæ of its crystals. At a high temperature it melts; and at a still higher, gives out oxygen, and is resolved into hyponitrite of potassa, which, if the heat be further increased, is in its turn decomposed, with the escape of a mixture of oxygen, nitric oxide, &c. Nitre may be known to contain potassa by affording a yellow precipitate with chloride of platinum, and nitric acid, by causing live coals to burn more briskly when thrown upon them, and by yielding whitish or reddish fumes when decomposed by sulphuric acid.

1. *Effects on the System.*

In small doses, repeated at short intervals, as ten grains, for example, every two hours, nitre diminishes the frequency and force of the pulse, and the temperature of the body, and at the same time very often acts as a diuretic or diaphoretic, evincing generally a preferable direction to the kidneys, but sometimes acting on the skin, especially when administered with warm drinks, or in conjunction with other diaphoretic medicines. When

taken in powder, it sometimes occasions a feeling of coolness in the stomach, and a general chilliness, probably through the absorption of free heat during its solution. In larger doses it produces these effects more decidedly. Mr. Alexander found a drachm of it, on several occasions, to reduce the frequency of the pulse, within a few minutes, from 70 to 60. (*Essays*, p. 105.) In quantities increasing gradually from one to five drachms daily, in divided doses, continued for somewhat more than a week, it was observed by F. Löffler, several times, towards the close of the period, to diminish the pulse to 20 beats in the minute. Along with this reduction of the circulation, there were feelings of general weakness, mental depression, and drowsiness. (*Am. Journ. of Med. Sci.*, xviii. 204.) From quantities varying from two scruples to one or two drachms, given three times a day, dissolved in a large proportion of barley water, and continued for a week or longer, Dr. John Cargill generally observed no inconvenience; but occasionally, in persons of nervous temperament, noticed as the result of its influence, general tremblings, difficulty of speech, giddiness, abnormal sounds in the ears, partial forgetfulness, and an extraordinary debility of the limbs, especially the lower, which sometimes seemed to the patient as though paralyzed. (*Lond. Med. Gaz.*, Oct. 1851, p. 640.) In still larger doses than those mentioned, if given dissolved in a very large quantity of water, nitre seems to act mainly as a purgative. M. Devilliers states, as the result of his own experience, that from half an ounce to an ounce of it may be given as a purgative, not only without inconvenience, but often with advantage (*Dict. des Sci. Med.*, xxxvi. 138); and the same fact is asserted by many other writers, among whom are Merat and De Lens, who declare that their own experience is confirmatory of that of M. Devilliers. (*Dict. de Mat. Med.*, v. 479.) When long continued, even in moderate doses, nitre is said to produce chronic irritation of the stomach, impair digestion, and debilitate the system generally; and by some it is thought to deprave the blood, and favour the generation of a typhoid condition.

Poisonous Effects. Numerous instances of death from large quantities of nitre, taken by mistake for some other saline substance, are on record; and until recently it has generally been considered as essentially poisonous in excessive doses. But experience has, within a few years, abundantly shown, that its noxious effects are ascribable to the manner in which it is taken, rather than to any necessarily poisonous quality. It is when swallowed in

powder, or concentrated solution, that it acts thus injuriously. From the doses of two scruples up to two drachms, above mentioned, as having been given by Dr. Cargill with entire safety, when dissolved in not less than half a pint of barley water for each dose, the same writer observed, if they were exhibited in concentrated solution, very unpleasant effects, such as intense griping pain, great thirst, anxiety, pallor of the face, cold perspiration, and a reduced pulse. The symptoms, however, disappeared under free dilution. (*Lond. Med. Gaz., ut supra.*) One ounce has often acted as a violent poison, and in several instances has caused death. Any quantity above three or four drachms may be considered poisonous, if taken in powder, or dissolved in only a small quantity of water. The symptoms usually produced, though not all ordinarily in the same case, are heat and severe pain in the stomach, vomiting and purging, bloody discharges, griping pains in the bowels, feeble pulse, cold extremities, great muscular debility, faintness, insensibility, and sometimes convulsive movements before death. Vomiting does not always occur, and, when it happens early is rather favourable than otherwise: as it may evacuate the poison. Dr. Christison knew a case, in which an ounce was taken without any other unpleasant symptom than vomiting, which took place in fifteen minutes. Sometimes death happens with little other obvious effect than great prostration. A case is recorded by Dr. John W. Snowden, of N. Jersey, in which a man, having taken three ounces and a half of nitre at one dose, at the end of five hours suddenly fell from his chair and died, with no other preceding phenomena than a slight sense of heat in the epigastrium, thirst, and three operations on his bowels. (*N. Jersey Med. Reporter*, viii. 117.) In the fatal cases, death has generally occurred within a period varying from two to five hours. Signs of inflammation of the mucous membrane of the stomach, sometimes attended with gangrene, have generally been noticed upon post-mortem examination. In a case which came under the notice of Dr. Geoghegan, of Dublin, in which death resulted in two hours from an ounce or an ounce and a half of the salt, the membrane was found much inflamed, but none of the salt could be detected in the stomach. (*Taylor on Poisons.*) The rapidity with which the fatal effect is produced is much greater than is generally the case from the most violent corrosive poisons, as arsenic, corrosive sublimate, or even sulphuric acid. Inflammation of the stomach, therefore, is probably not the main cause of death. Besides, in the case of Dr. Snowden, above

mentioned, there were no symptoms of gastric inflammation. In that of Dr. Geoghegan, in which death occurred in two hours, and none of the salt was found in the stomach, the poison must have been rapidly absorbed. Hence it may be inferred, that death occurs in consequence of the entrance of the poison into the circulation. Of its mode of operating when there, I shall treat immediately.

In the *treatment* of poisoning from nitre, if the patient has not vomited, ipecacuanha should be given till this effect is produced; warm diluent and demulcent drinks should be given, in any event, in order to dilute the salt, and to wash out the stomach; an opiate enema should be administered, or laudanum by the mouth; a sinapism applied over the epigastrium, and the patient's strength supported, if necessary, by wine or brandy diluted. There is no known antidote to nitre.

2. *Mode of Operating.*

Nitre in powder, or concentrated solution, is somewhat irritant to the stomach, and in large quantities often powerfully so; but there can, I think, be little doubt that its effects, whether remedial or toxicological, are produced mainly through its absorption. That it is absorbed, is shown not only by its disappearance from the stomach, but by its appearance in the urine, in which it has been repeatedly detected. It has also been found in the blood of a person to whom it was given in large doses. (*Journ. de Pharm.*, x. 413.) Its diuretic and diaphoretic action is explained by its stimulant influence upon the secretory function of these organs, as it is carried through them with the blood. Its purgative effect in large doses, with very free dilution, probably depends on a direct irritant action upon the intestinal mucous membrane. But the question as to the cause of its sedative influence over the circulation is not so easily settled. Does this depend upon an action directly on the heart, or first on the organic nervous centres and through them on the heart, or upon the blood, and through that both on the nervous system and the heart? In order to answer this question, we must ascertain how far nitre is known to affect the condition of the blood. It is asserted that, when added to freshly drawn blood out of the body, it impedes coagulation, and diminishes the adhesiveness of the red corpuscles, which it is said also to redden. Upon these points the statements made are so positive, that they cannot well be doubted.

It is a very probable inference, that the same effects would, to a certain extent, result from the absorption of nitre into the circulation. The salt is indeed supposed, even in medicinal doses, to diminish the plasticity of the blood; and has been thought, if long continued, to bring on a depraved condition of that fluid, disposing to a typhoid state of the system. In cases of death from poisonous doses, it has been repeatedly noticed that the blood was liquid and uncoagulable. Statements generally agree on this point, though they differ as to the colour of the blood, which has sometimes been found black, in others redder than in health. Thus, M. Nonat, in a case of death from about an ounce, found the blood liquid and black (Briquet, *Trait. Therap. du Quinquin.*, &c.): while in another, referred to by Dr. Stevens, it was quite florid (*Observ. on the Blood*, p. 298); and, in the instance above mentioned as having been seen by Dr. Snowden, the lips were bright red. From the experiments of M. Briquet, it appears that nitre injected into the veins of a dog, reduces immediately the force of the heart, as measured by the hæmodynameter. (*Traité, &c., ut supra*, p. 111.) From six grains to half a drachm are said, when used in this way in dogs, to cause sudden death, as if by paralysis of the heart, preceded sometimes by convulsions. (Merat et de Lens, *Dict.*, &c., v. 481.) From all these facts it appears probable, that nitre operates immediately by depreciating the character of the blood, and secondarily diminishing the powers and actions of the heart; though it is not impossible that it may exert a direct sedative influence on that organ. There is no proof that it has any direct action on the nervous centres. When given in small doses, it is absorbed, and moderately depresses the circulation, while it stimulates the skin or kidneys to throw it off. Larger doses irritate the mucous membrane, and, while partly absorbed, often operate on the bowels, and are in some measure discharged from the system. Still more largely given, if accompanied with a very large quantity of liquid, it is in like manner partly absorbed, and partly in general carried off by the bowels; but from its dilution it is but slightly irritant, and from the great bulk of liquid can be but slowly taken into the circulation, and not faster than it may be eliminated by the kidneys and skin; so that there is at no one time sufficient in the blood to produce serious effects. But in large quantities, as from half an ounce to an ounce and upwards, if swallowed in concentrated solution, it both irritates the stomach into inflammation, and, in its passage through the canal, is, from its small bulk, absorbed almost wholly, and thus entering the

blood in larger quantities and greater concentration, exerts its full powers upon that liquid and upon the heart, poisoning the former, so as to give it the character of the blood in the most fatal malignant fevers.

3. *Indications and Contraindications.*

Nitre would seem, from its known properties, to be called for in sthenic states of the system, with increased circulatory excitement and febrile heat, and especially when there is an excess of fibrin in the blood, or a disposition in inflammatory diseases to plastic exudation, or the formation of false membrane. It is contraindicated by general debility, an aplastic condition of the blood, as in low or typhoid states of system, and by inflammation of the stomach and bowels.

4. *Therapeutic Application.*

The diseases in which nitre is employed as a sedative are the phlegmasiæ, acute hemorrhages, and inflammatory fevers. It has also been used in scurvy.

1. *Inflammations.* It may be used in any of the acute inflammations with a sthenic state of the system, except those of the stomach and bowels, and perhaps those of the kidneys and bladder, in which it may be supposed to act injuriously by its local stimulant properties, as it passes out with the urine. But the particular phlegmasiæ in which it has been most highly recommended, and to which it would appear to be specially applicable from its peculiar influence on the blood, are *pneumonia* and *acute rheumatism.* In these it has generally been given combined with tartar emetic, or with this and calomel, in the form of the *nitrous powders.*

But it is necessary to treat more particularly of a mode of using it in *acute rheumatism*, which, though employed by Dr. Brocklesby, of England, in the middle of the last century, was not generally adopted, and seemed to have been forgotten, until revived in 1833, in France, by MM. Gendrin and Martin Solon, whose example has been followed by other practitioners with considerable success. This method consists in administering the medicine in large doses, dissolved in a very large proportion of water, or some demulcent or slightly nutritive fluid, as barley water, sweetened water, thin gruel, lemonade, &c. Half an ounce is given, in divided doses, during the first period of twenty-four hours, and gradually increased to six, eight, or even twelve drachms, in the same period of time. The mean quantity administered daily is about an ounce.

The proportion of liquid employed is three quarts to an ounce of the salt; so that four fluidounces of the solution, containing twenty grains, may be given at such intervals as to amount to the required quantity in the day. The proportion of liquid may be somewhat diminished when found to oppress the stomach; but the operation should be carefully watched, and the remedy suspended upon the occurrence of any disagreeable effects. It must be borne in mind, that the large dilution is necessary to avoid poisonous results. In general copious diaphoresis is produced, when the patient is confined to bed and well covered. Sometimes, however, the remedy operates as a cathartic, and sometimes as a diuretic. The mean length of time required for the cure of the disease is stated at eight days. The remedy is said to be very generally successful; but it sometimes fails.

To *chronic rheumatism* it was supposed not to be adapted: but the experience of Dr. John Cargill would lead to a different conclusion. Of one hundred cases treated with nitrate of potassa, sixty-one were cured, and the average length of treatment was about two weeks. Of the remaining cases, twenty experienced great relief, five were but slightly benefited, three were in no degree benefited, three became worse, and of the result in eight nothing positive could be stated. At the beginning of the treatment, forty grains were given dissolved in barley water three times a day; and this quantity was sometimes continued throughout the case; but generally the dose was increased to sixty, ninety, or one hundred and twenty grains, given at the same intervals, or every four hours. Not less than eight fluidounces of liquid were given with each dose. If accidentally administered with but little water, the medicine occasioned intense griping pain, with anxiety, depressed circulation, &c. In some rare instances, in persons of nervous temperament, general tremors, great muscular weakness, giddiness, &c. were produced; but the symptoms subsided in a few hours with diuresis or perspiration. I have been thus particular in this account, as, if the experience of others should be found to coincide with that of Dr. Cargill, the remedy will certainly rank among the most effectual in chronic rheumatism; and, in order that it may be fairly tried, the circumstances under which it proved successful should be stated. The duration of the cases before treatment had often been long, varying generally from two months to five or six years. (*Lond. Med. Gaz.*, Oct. 1851, p. 640.)

From its supposed aplastic properties, nitre, used in the same

method, might be tried in *pseudomembranous croup;* the dose being of course accommodated to the age of the patient.

2. *Active Hemorrhages.* It is only for its sedative action on the heart that nitre is indicated in the active hemorrhages; and its use has been chiefly confined to hæmoptysis. So far as it has aplastic properties, it is contraindicated in these cases; and, in all hemorrhages attended with a deficiency of healthy fibrin, it could probably do only mischief; the prompt and efficient coagulability of the blood being the condition most favourable to the arresting of the discharge.

3. *Fevers.* It is only in the sthenic cases of fever, with an energetic condition of the circulation, and an unimpaired condition of the blood, that nitre should be employed. It has been considerably used in the inflammatory forms of our bilious remittent fever, during the exacerbations, in the form of nitrous powders.

4. *Scurvy.* In some cases of scurvy, nitre has been found of advantage; and, if the views of Dr. Garrod be correct, that a deficiency of the salts of potassa in the blood is a prominent characteristic of the affection, its beneficial operation may be explained. It was formerly supposed that the blood in scurvy was peculiarly defective in plasticity; but this has been found not to be true in most cases recently investigated; so that any objection to the use of nitre in that complaint, founded on its aplastic properties, must be considered as at least not generally applicable.

Of the use of nitre as a diaphoretic and expectorant, more will be said when we reach the classes characterized by these properties respectively.

5. *Administration.*

The ordinary dose of nitre is from five to fifteen grains, repeated every hour, two, or three hours; from one to three drachms being administered in the course of the day. It may be given in powder or solution. The former method has been recommended, on account of the coldness produced during the solution of the salt in the stomach; but this advantage is more than counterbalanced by its liability to produce irritation, when taken in this method; and if cold is wanted, it may be more readily obtained by means of ice. It should, therefore, I think, in general, be preferably given in solution. Both in this form, and in that of powder, it is often associated with tartar emetic.

The NITROUS POWDERS, which have been much used in inflamma-

tory and febrile diseases, offering an indication for the mercurial impression, as in bilious fever and hepatitis, are prepared by mixing thoroughly one drachm of nitre, one grain of tartar emetic, and from four to sixteen grains of calomel, and dividing into eight powders, of which one may be given every two hours, or less frequently. The proportion of calomel is necessarily variable, to accommodate the variable circumstances requiring it.

The mode of exhibiting nitre in large doses has already been sufficiently treated of. When given in quantities exceeding fifteen or twenty grains, it should be dissolved in not less than eight fluid-ounces of liquid to a drachm of the salt; and still larger proportions of the menstruum may often be used with advantage.

Local Use. Nitre is sometimes locally used in *sore-throat*, either dissolved in water as a gargle, or mixed with sugar and allowed gradually to dissolve in the mouth. Employed in the latter method, it has the advantage of producing coolness by its solution in the saliva.

Another local application of nitre is in *fumigation*. For this purpose, blotting-paper is employed, impregnated with nitre by being dipped once or oftener into a saturated solution of the salt, and dried after each immersion. The paper may be set on fire on a plate, or rolled up in a cylindrical form and placed in a candle-stick; and the patient may inhale the fumes as they rise, or simply breathe the air of the apartment. It may also be smoked by means of a tobacco-pipe. This fumigation sometimes affords great relief in the paroxysms of asthma. I know a patient who finds more relief from this than from any other remedy.

Nitre is also sometimes employed remedially for producing cold, for external use, when ice or cold water cannot be obtained. Five ounces of nitre, with the same quantity of muriate of ammonia, dissolved in a pint of water, may be introduced into a bladder, and applied to the head, in the headache or delirium of fever and meningitis, or elsewhere when required.

III. VEGETABLE ACIDS.

Most of the vegetable acids of a sour taste have a certain resemblance in effect, which serves to group them together as a subordinate division of the class of arterial sedatives or refrigerants, to which they undoubtedly belong.

Effects on the System. These acids are locally excitant, but, in their general influence on the system, are sedative to the circulation. In small quantities, and largely diluted with water, they are generally grateful to the palate, and acceptable to the stomach, which they moderately excite, as shown by their sharpening effect on the appetite. After a time, they render the pulse somewhat slower and softer, and diminish the general temperature; and, if the system is somewhat excited, have an agreeable and refreshing effect upon it. They often also moderately promote the secretions, especially that of the kidneys; but this influence on the secretory functions is not generally very obvious, unless there has previously been a diminution of the functions from an over-excitement of the organ, as when the skin is dry and heated, or the liver inactive from congestion. Under such circumstances they appear to act by a sedative influence on the capillaries, the irritation of which is reduced to a point at which secretion can take place. Hence the moisture of surface, and the gentle flow of bile, which occasionally follow their administration in the conditions just referred to. In the same way they seem occasionally to relax the bowels, and to promote pulmonary exhalation.

When taken too largely, and too long, they are apt to produce irritation of the gastro-intestinal mucous membrane, to lessen the appetite and disturb digestion, and, partly through this effect, and partly, in all probability, through a direct depression of the circulatory function, to impair the organic processes generally, and thus occasion paleness, general weakness, and emaciation.

In large doses, in a concentrated state, they are capable of acting as poisons; and one of them at least, the *oxalic acid*, is extremely noxious. They appear to operate poisonously in two ways; *first*, by inflaming, if not corroding, the mucous membrane of the stomach and bowels; and *secondly*, by a powerfully depressing influence on the heart, exerted either directly, or through the altered blood.

Mode of Operating. The local irritant effect of the acids results from their contact with the surface affected; their sedative operation upon the circulation takes place through absorption. Whether they enter the blood as acids is not certainly known, as they have not been detected in that fluid in the free state; but the probability is that they generally do so, and always, when they do not meet a free or carbonated alkali in the stomach or bowels, in sufficient quantity to saturate them. After entrance, however, they certainly do not remain free, but probably instantly combine with the alkaline matter

of the blood, and operate through the compounds thus formed. The similarity, we might almost say the identity, of their sedative action with that of the refrigerant salts, may thus be readily understood. It is the saline combination formed in the blood, and not the acid, that acts. Hence, too, it happens that they cannot be detected in the free state in the secretions. It is true that they are capable of rendering the urine acid, as shown by the experiments of Dr. H. Bence Jones with lemon-juice (*Lond. Med. Times and Gaz.*, Oct., 1854, p. 408); but this acidity has not been shown to depend on the presence of the acid used, and is probably merely an increase of the normal acidity, which has been ascribed to uric acid, but the source of which has not been satisfactorily demonstrated. This much has been determined, that the quantity of uric acid set free in the urine is increased by the copious use of the vegetable acids; and it is highly probable that the latter, on entering the circulation, possess themselves of the alkaline base with which the former is there combined, and thus cause its elimination. Sometimes the saline compound formed by the acid after exhibition may be detected in the urine.

The only acids belonging to the present category, which are used medicinally to any considerable extent, in the uncombined state, are the *citric* and *acetic*, which are generally taken in the form of lemon-juice and vinegar. The *tartaric* is sometimes employed, though generally as a chemical agent. *Oxalic acid*, in small doses, is said to have similar properties; but it is so liable, in consequence of the resemblance of its crystals to those of Epsom salt, to be taken for it through mistake, and is so fearfully poisonous in overdoses, that no good which could be derived from its employment as a medicine would compensate for the danger.

I. CITRIC ACID.—ACIDUM CITRICUM. *U. S.*, *Lond.*, *Ed.*, *Dub.*

Origin and Preparation. Citric acid exists in various acid fruits, as the sour orange, lemon, lime, tamarind, &c.; but it is in the form of lemon-juice that it is most frequently employed. The juice of the lime, which is the fruit of *Citrus acris* of Miller, may be considered as identical, and used with it indiscriminately.

Lemon-juice (SUCCUS LIMONUM, *Lond.*) is obtained from the *lemon* (LIMON, *U. S.;* LIMONES, *Ed.*), or fruit of *Citrus medica*, by simple expression. It is of a sharply acid, but agreeable taste, which, as

well as its medical virtues, it owes to the citric acid contained in it. According to the experiments of Dr. H. Bence Jones, it contains about 6 per cent. of the pure anhydrous acid (*Lond. Med. Times and Gaz.*, Oct., 1854, p. 408); but the proportion varies exceedingly. Other constituents are mucilage, extractive, and a very small proportion of saline matter, of which citrate of potassa constitutes by far the largest part. Some importance has been attached to this latter ingredient; but, when it is considered that an ounce of the juice contains, according to Dr. Jones, less than two grains of the salt, it must be admitted that any views of its operation, founded upon this constituent, must rest on a very narrow basis. For medical purposes, it is generally best to employ the juice in a fresh state; but, as lemons cannot always be obtained, it is important to be able to preserve it, especially for use on long voyages. When the juice cannot be obtained unaltered, recourse may be had to the pure acid.

Citric acid is separated from lemon or lime-juice by boiling the juice, saturating it completely with carbonate of lime, washing the insoluble citrate of lime thus procured, and decomposing it with dilute sulphuric acid, which forms an insoluble sulphate of lime, and leaves the citric acid in solution. This is then obtained, in a crystallized state, by concentrating the solution sufficiently, and allowing it to cool.

Properties. The crystals of citric acid, when perfect, have the form of rhomboidal prisms with dihedral summits; but they are seldom regular, as kept in the shops. They are transparent, colourless, without smell, extremely sour, fusible in their own water of crystallization, very soluble in water, and less soluble in alcohol. The watery solution becomes mouldy by keeping. As tartaric acid is often substituted for, or fraudulently mixed with the citric, it is important to be able to detect its presence. This may be done, with great facility, by making a strong solution of the suspected acid in water, and then adding a rather strong solution of carbonate of potassa. If the citric acid is pure, there will be no precipitate; if tartaric acid is present, there will be a deposit of bitartrate of potassa. Citric acid is wholly dissipated by a red heat; and lime or other fixed impurity may thus be detected. The crystals consist of 12 eqs. of carbon, 5 of hydrogen, and 11 of oxygen, with 4 eqs. of water.

A *substitute for lemon-juice* sufficiently near it in acid strength, may be made by dissolving an ounce of the crystals in a pint of

water; and the flavour may be improved, by rubbing up four drops of oil of lemons with the acid before dissolving it.

Effects on the System. So far as the action of remedial doses is concerned, the effects of citric acid are the same as those of the vegetable acids in general, already detailed. But there is some doubt in relation to the operation of very large quantities. Mitscherlich found that a drachm of citric acid acted violently on a rabbit, without killing it; but that two drachms proved fatal to a large animal of the same species in an hour and a half. Dr. Christison, on the contrary, gave a drachm to a cat with perfect impunity. No positive inference can be drawn from these results as to the effect of large doses on man. As they differed so much in two different species of the inferior animals, there is no reason to suppose that the action of the acid in either of them, is a proper measure of its influence on the human subject. By Orfila it is ranked with the irritant poisons. It cannot, however, be very poisonous, if given largely diluted; for Dr. Babington, of London, gave six ounces of lemon-juice, equivalent to about three drachms of the crystallized acid, three times a day in acute rheumatism, not only without unpleasant effects, but with great advantage. The only unequivocal effect, uniformly observed, was a diminution in the frequency and strength of the pulse, and the heart's action. It had no laxative effect, and no other action on the kidneys than to increase the discharge, through the influence of the quantity of liquid. (*Lancet*, Nov., 1851, p. 431.) Nevertheless, until further experiment has decided the question, it would be safest to avoid very large doses, especially in concentrated solution. From the experiments of Mitscherlich on rabbits, it is inferred that the blood is rendered thinner and less coagulable by its use, and the powers and actions of the heart reduced, without any inflammation of the stomach, even from poisonous doses. (*Lond. Med. Times and Gaz., loc. citat.*) Taken too freely and too long, it disturbs digestion, and tends to impair nutrition.

Therapeutic Application. In the form of lemonade, or added to barley water, or other slightly nutritive drinks, lemon-juice is much used, as a cooling and refreshing beverage, in inflammatory and febrile diseases, and is no doubt positively beneficial as well as agreeable. It suits an irritated stomach better than any other of the vegetable acids.

Within a few years it has been employed by some as the main agent in the cure of *inflammatory rheumatism*, having been first

used for this purpose by Dr. Owen Rees, of London, who gave one or two fluidounces of lemon-juice from four to six times a day, and found it very effectual. Other practitioners have since used it with the same favourable results. Dr. Wm. Pepper, of Philadelphia, found it greatly to relieve the disease in a week or less time; and the patients were generally cured in less than two weeks. (*Trans. of Col. of Phys. of Philad.*, N. S., i. 124.) By some it has been given much more largely; and by Dr. Babington, as above stated, in doses of six ounces three times a day. Other practitioners have been less successful with it; and my own experience has not been specially favourable, though too limited to authorize a decided opinion upon that ground alone. My impression is that it acts favourably as an arterial sedative in the disease, in a manner similar to nitrate of potassa, without having any peculiar or specific influence over it; and it must be remembered, in estimating its efficiency in acute rheumatism, that this disease generally terminates favourably of itself, and often ends in recovery, under an expectant plan of treatment, within the period in which it is claimed that lemon-juice cures it.

Dr. Rees has also found the remedy very advantageous in certain cases of *chronic rheumatism*, connected with deposition of urate of soda in and about the smaller joints, and partaking, as he properly observes, more or less of the gouty character. By the continued employment of the juice in these cases, in combination with small doses of the tincture of chloride of iron, he has succeeded in effecting the absorption of deposits, which had resisted all other plans of treatment. (*Lancet*, Dec. 1850, p. 651.)

This acid has been supposed to act through the citrate of potassa it contains, and thus really to coincide in effect with the alkaline salts of the vegetable acids, which are thought to render the blood alkaline by the decomposition of their acid ingredient, and the formation of a carbonate of the base. But when the very minute proportion of citrate of potassa which it contains, as determined by Dr. H. Bence Jones, is considered, this explanation of its mode of operation must be admitted to be extremely questionable. I have often administered in rheumatism, every two or three hours, ten times the quantity of citrate of potassa contained in a fluidounce of lemon-juice, without any obvious effects, other than such as usually flow from refrigerant diaphoretics.

Another and much more important application of lemon-juice is to the cure and prevention of *scurvy*. There is, perhaps, no other

single remedy which exercises a more powerful influence over this disease. It should be drank freely in the form of lemonade, and two or three fluidounces or more should be given daily. It is of the greatest importance, however, that the juice should be of good quality, and well preserved. It should be made from sound lemons or limes; and, if taken upon long voyages, should be preserved in one of the two following methods. *First*, lightly boil the juice, then strain, and, after having allowed it to become quite cool, pour it into bottles up to their neck, fill the vacant space above with pure olive oil, cork tightly, and seal thoroughly with sealing wax. *Secondly*, add to the juice 10 per cent. of brandy, and bottle it, with the addition of the olive oil, as in the first method. Sir Wm. Burnett has published the strongest testimony in favour, not only of the efficacy of the juice prepared in these methods, but of its permanence without change for years. A comparative trial was made, under his direction, of different antiscorbutics. Pure citric acid was, in many instances, found useful as a remedy in scurvy; but lemon-juice seems to have been more successful than this or any other substance, both as a remedy and preventive. (*Lond. Med. Times and Gaz.*, Dec. 1854, p. 635.) The efficacy of the juice has been ascribed to the potassa contained in it, on the score of the fact, ascertained by Dr. Garrod, that the alkali referred to is deficient in the blood of scorbutic patients. But against this opinion the same objection may be urged as in the case of acute rheumatism; the extremely minute quantity, namely, in which potassa is found in lemon-juice, an ounce of which, according to Dr. Jones, contains only three-quarters of a grain.

Lemon-juice is an excellent *antidote* to poisonous doses of the alkalies or their carbonates.

It is much used in preparing the citrates of potassa and ammonia, either in the form of neutral mixture or effervescing draught. These, however, will be treated of with the diaphoretics.

It is sometimes used in conjunction with opium or Peruvian bark, under the impression that it advantageously modifies their effects by the substitution of the citrate of their respective alkaloids, for the native salt.

As a topical remedy, the juice has been used for the *suppression of uterine hemorrhage after delivery*. For this purpose, it has been recommended to introduce a lemon, previously peeled and cut, into the cavity of the uterus, and then to express the juice. The uterus contracts under the stimulus, and closes the bleeding

orifices. It has also been useful in sloughing ulcers, and as an application in pruritus of the genitals.

Administration. Most that is requisite in relation to the mode of administering lemon-juice, and to its dose has been already stated. Lemonade may be prepared by putting a lemon of medium size, cut into transverse slices, in a pint of boiling water, adding half an ounce or an ounce of sugar, and allowing the liquid to cool; or half a fluidounce of the juice may be simply mixed with half a pint of water, and sweetened to the taste. It is often advantageously administered iced in fevers. A solution of citric acid may be substituted, when lemon-juice is not to be had. The strength of such a solution, equivalent to lemon-juice, has been already mentioned. In preparing a substitute for lemonade, twenty or thirty grains of the acid may be added to a pint of water, and sweetened with sugar which has been rubbed on fresh lemon-peel, or flavoured with the essence of lemon.

II. ACETIC ACID.—ACIDUM ACETICUM. *U. S., Lond.*

Acetic acid exists in the juice of some vegetables, but is not extracted for use. It is officinal in four forms; namely, the strong acid, the diluted acid, vinegar, and distilled vinegar. For internal use vinegar is generally preferred. I shall first describe, so far as may be deemed necessary, these several forms, and afterwards treat of their applications conjointly.

1. VINEGAR.—*Acetum.* U. S., Lond.—This is the product of the acetous fermentation, by which alcohol in dilute solution is converted into acetic acid, through the agency of some azotized substance acting as a ferment, and of a temperature between 75° and 90° Fahr. All saccharine juices or solutions, which by the vinous fermentation become alcoholic liquids, may, by the continued influence of heat and a ferment, be changed into vinegar. In France, vinegar is usually thus made from wines, in Great Britain from malt liquor, and in the United States from cider; and the strength and flavour vary, according to the character of the liquid from which it is prepared. Not unfrequently, also, vinegar is made from artificial mixtures of water and saccharine matter, with the addition of a ferment.

Properties. Vinegar fit for internal use is of variable colour, from a very pale yellow, to a deep reddish-brown. It has an agreeable peculiar odour, and a sharp, acid taste. If kept long exposed

to the air, it is decomposed. The ingredient on which it depends for its medical properties is acetic acid, besides which it contains various organic and saline substances in small proportion, some of which serve to qualify agreeably its odour and taste. It has the property, in some degree, of preserving organic matter from decomposition, and is often used for this purpose in pickling. To increase its apparent strength, sulphuric acid is not unfrequently added. This may be detected by boiling the liquid with chloride of calcium, which throws down any free sulphuric acid as sulphate of lime, without affecting the small proportion of sulphates contained in the vinegar. When used medicinally, it should be free from this impurity, as well as from copper and lead, sometimes imparted to it by the vessels in which it is prepared.

2. Distilled Vinegar.—*Acetum Destillatum.* U. S., Lond., Ed.—This is prepared by simply distilling common vinegar; a portion containing the impurities being left behind in the retort. It is a limpid, colourless liquid, having the acetous odour and taste, but less agreeable to the palate than the undistilled. The vinegar is deprived, in the process, of its solid constituents, but not entirely of volatile organic impurity. The preparation is of variable strength, corresponding with that of the liquid from which it was obtained. Distilled vinegar is used almost exclusively in pharmacy, being preferred to the common as a menstruum, on account of its greater purity.

3. Acetic Acid.—*Acidum Aceticum.* U. S., Lond.—*Acidum Pyroligneum.* Ed.—As directed by the U. S. and London Pharmacopœias, this is not pure acetic acid, as it contains a considerable proportion of water. It is generally prepared from the pyroligneous acid, or impure empyreumatic vinegar obtained by the destructive distillation of wood. With this liquid there is first made an impure acetate of soda, which, having been purified and crystallized, is exposed to distillation with strong sulphuric acid. The acetic acid comes over, with the water of crystallization of the acetate and that of the sulphuric acid, leaving sulphate of lime in the retort.

Properties. The acetic acid of the U. S. Pharmacopœia is a colourless liquid, very volatile, with a pungent acetous odour, and an extremely sour and sharp taste. It combines readily with water and alcohol. Heat volatilizes it entirely. It contains about 36 per cent. of *monohydrated* or *glacial acetic acid*, which is the strongest employed.

The *glacial* or *monohydrated* acid is prepared from acetate of lead

by first heating it to drive off its water, and then decomposing it either with dry muriatic acid gas, or by strong sulphuric acid. It is a colourless liquid similar to the above, but much stronger and quite insupportable to the taste. At the temperature of 40° Fahr. it solidifies. It contains 1 equivalent of pure acetic acid and 1 of water. The pure acid contains 4 eqs. of carbon, 3 of hydrogen, and 3 of oxygen.

4. Diluted Acetic Acid.—*Acidum Aceticum Dilutum.* U.S., Lond., Dub.—This is made by simply mixing one part by measure of the acetic acid of the U.S. Pharmacopœia with seven parts of water. It is intended to represent distilled vinegar, to which it is preferred for pharmaceutical use, on account of its greater purity, and more uniform strength.

Effects of Acetic Acid on the System. Acetic acid, in all its forms, is locally stimulant, and in its effects upon the system an arterial sedative. In the form of vinegar, diluted so as to be agreeable as a drink, it sharpens the appetite, and promotes digestion by its direct influence on the stomach. After absorption, it lessens the frequency and force of the pulse, and the temperature of the body, and often promotes the secretory functions, especially that of the kidneys. Sometimes also it operates as a diaphoretic and laxative. If largely taken and long continued, it irritates the stomach and bowels; diminishing the appetite, disturbing digestion, and causing not unfrequently nausea and diarrhœa. Under the same circumstances, it lowers the organic functions of the system generally, impairing nutrition, depraving the blood, producing anæmia and emaciation, and ultimately, it is said, inducing a condition analogous to the scorbutic.

The *concentrated, glacial*, or *monohydrated acid* is a powerful local irritant, inflaming and vesicating the skin, and even acting as a caustic if too long continued. It has the property of dissolving the albuminous bodies partially, and gelatin and the gelatinous tissues entirely; and hence, in part, its caustic properties.

When strong acetic acid is taken internally it acts as a poison, and, given to the lower animals, causes death with inflammation and gangrene of the stomach, and sometimes corrosion. One fatal case, occurring in a girl of about nineteen, is reported by Orfila. She was found dying on the highway. The symptoms mentioned were violent pains and convulsions. In the case of a man reported by Dr. Melion, a tablespoonful of the strong acid was taken by mistake. He was seized immediately with intense pain, and swal-

lowed largely of water. On the arrival of Dr. Melion, he complained of a burning pain in the chest and abdomen and a feeling of sickness, his mouth was white, the skin covered with perspiration, and the pulse very quick and small. Milk, carbonate of magnesia, and oleaginous liquids were administered; he was vomited and purged freely, and soon recovered. (*Taylor on Poisons.*)

Poisoning from acetic acid should be treated with magnesia or its carbonate and free dilution, and afterwards with opiates, to relieve irritation if it continue. Symptoms of gastric inflammation must be counteracted in the usual method.

Therapeutic Application. Vinegar, diluted with water, and sweetened if desired, may be advantageously used as a refreshing and sedative drink in *inflammatory* and *febrile diseases*, *active hemorrhages*, and other cases of *excessive vascular excitement;* but, as lemon-juice is more agreeable, and less irritating to the stomach, it is usually preferred.

Vinegar is not unfrequently employed with a view to *lessen obesity;* and it will no doubt sometimes produce this effect; but it must usually be at the expense of the general health, and is therefore a hazardous remedy. An instance is related, in which a young lady was apparently thrown into phthisis by the habitual use of vinegar, with a view to obviate fatness; and it is very intelligible that it should produce such an effect, as nothing is more favourable to the development of the tuberculous diathesis than that depreciated condition of the general health, ascribed to the abuse of vinegar.

With a view to its refrigerant and diuretic properties, it has sometimes been used in *dropsy;* and I was informed by Dr. Wm. W. Gregory, of North Carolina, that he had employed it with great success in that disease, in the quantity of a pint daily. It is peculiarly adapted to the cases attended with general excitement or local inflammation. In those dependent on, or associated with anæmia, it might be hazardous.

In *phosphatic deposits* in the urine, it is sometimes beneficial by promoting acidity of that secretion; but its liability to injure digestion would interfere with its long continued use in this affection.

In *poisoning by the alkalies* or their carbonates, it is one of the best antidotes, and generally the most convenient.

It is frequently employed with acetate of lead, to prevent its conversion into the carbonate; and, when the same salt is used externally, the turbidness caused by its solution may be corrected by a little vinegar. A few drops of it render the acetate of morphia

of the shops, which frequently contains a little undissolved morphia, quite soluble in water.

As a *topical remedy*, vinegar has been applied to various purposes. Diluted with twice or thrice its bulk of water, it has been used as an enema to procure evacuations from the bowels, to destroy the small thread-worm of the rectum, and to check hemorrhage from the bowels and uterus. It has been thrown up the nostrils to arrest epistaxis. Used in warm fomentation or by lotion, it is supposed to be beneficial in sprains and bruises. Very much diluted, it is useful in clearing the eye from the dust of lime adhering to the conjunctiva. The vapour of vinegar is sometimes refreshing to the sick; and lotions with the liquid to the arms and face, in febrile heat of the skin, are often grateful. It is sometimes applied as a stimulant to gangrenous and ill-conditioned ulcers; and gargles of it occasionally afford relief in anginose affections.

The *concentrated* or *glacial* acid has been employed for producing rubefaction and vesication of the skin. Applied to warts and corns, it will sometimes cause their removal. It has been highly recommended in porrigo favosa, or proper scaldhead; each one of the small cryptogamic eruptions being touched with it, by means of a camel's hair pencil. Held to the nostrils, it is serviceable by its pungency in partial or complete syncope, apnœa, languor, and nervous headache. Dropped on sulphate of potassa, with a little oil of bergamot, and inclosed in a small glass-stoppered bottle, it forms an agreeable variety of smelling salts.

Many of the above uses of acetic acid have no relation to its properties as an arterial sedative; but it is proper that they should be mentioned; and there is no other place in which this could be done more conveniently than the present.

The dose of vinegar is one or two tablespoonfuls, which may be given in a tumbler of sweetened water. Three times this quantity may be given by enema.

III. TARTARIC ACID.—ACIDUM TARTARICUM. *U. S., Lond., Ed., Dub.*

Preparation.—Tartaric acid exists, in the free state, in several vegetable juices, among which are those of grapes, tamarinds, and pine-apples. For use, it is obtained from bitartrate of potassa, by first saturating the excess of tartaric acid in that salt by means of carbonate of lime, and then decomposing, by sulphuric acid, the insoluble

tartrate of lime produced; water, of course, being employed in the process, to facilitate the reactions. In the last step of the process, insoluble sulphate of lime is formed, and the liberated tartaric acid remains in solution, from which it is separated by concentration and crystallization.

Properties. The crystals are irregular six-sided prisms, sometimes flattened into a tabular form, whitish, translucent, permanent in the air, inodorous, and of a very sour taste, which is agreeable when they are in weak solution. As usually kept in the shops, the acid is in the state of a white powder. It is very soluble in water, and is soluble also in alcohol. The aqueous solution undergoes decomposition when kept. The anhydrous acid consists of 4 eqs. of carbon, 2 of hydrogen, and 5 of oxygen; which, in the crystalline form, are united with 1 eq. of water.

This acid may be recognized by forming, with a strong solution of carbonate of potassa, a copious precipitate of the bitartrate.

Effects on the System. These are the same as those of the sour vegetable acids in general. The acid is locally excitant, or, in a concentrated state, irritant; and, upon the system at large, acts as an arterial sedative, with a disposition to promote the urinary secretion, and sometimes to act as a laxative.

Dr. Christison states, in his treatise on poisons, that he had given a drachm to cats without any observable inconvenience; and mentions an instance, on the authority of a surgeon of his acquaintance, in which six drachms were taken during twenty-four hours, without producing any troublesome effects. Mitscherlich, however, killed a rabbit in an hour with three or four drachms; and, when less than sufficient to cause death was given, the symptoms were those of depression and paralysis. Dr. Taylor, in his work on poisons, gives the details of a case, in which a man, having swallowed an ounce of the acid, dissolved in half a pint of water, complained immediately of a burning pain in his throat and stomach, and was attacked with vomiting, which continued until his death, nine days after it was taken. Almost the whole of the alimentary canal was found inflamed. The acid must, therefore, be considered as an irritant poison in very large doses. The treatment of its poisonous effects is the same as in the case of poisoning by acetic acid.

Therapeutic Application. Dissolved in water and sweetened, tartaric acid may be used as a cheap substitute for lemonade in febrile affections; but it is less agreeable, and more apt to irritate the stomach. It is chiefly employed in the preparation of effervescing

laxative and refrigerant powders. For an account of the *Seidlitz powders*, in which it forms an ingredient, the reader is referred to the article upon the tartrate of potassa and soda, or Rochelle salt. The common *soda powders*, as usually prepared, consist of 25 grains of powdered tartaric acid in one paper, and 30 grains of bicarbonate of soda in another. When used, the powders are dissolved in separate portions of water, and the two solutions then mixed. Carbonic acid escapes with effervescence, and tartrate of soda remains in solution. The quantity of water employed may be from four to eight fluidounces. The preparation is taken while effervescing, and the dose may be given every two or three hours in febrile affections. It operates gratefully as a refrigerant, and often as a gentle laxative, and is much used. The same ingredients, previously well dried, may be mixed in larger quantities, but in the same proportion, and kept in well-stopped glass bottles. A teaspoonful of the mixture, thrown into a gill of water, will form an effervescing solution, as in the former method. In either case, simple syrup, or the syrup of orange-peel, may be added to the liquid used. About fifteen grains of the acid, dissolved in a tumbler of sweetened water, produces an agreeably sour solution, which may be used for a drink in fevers.

CLASS II.

NERVOUS SEDATIVES.

THESE are medicines which, by a direct influence, reduce nervous power, while they also depress the circulation. They appear to affect especially the organic nervous centres, without a peculiar direction to the cerebral functions; and bear to the cerebral sedatives a relation somewhat similar to that which, with an opposite mode of action, the nervous stimulants bear to the cerebral. It is not certainly known whether their sedative influence on the heart is direct, or exercised through the intervention of the nervous system; but, as there is a strong analogy in the operation of the several members of the class, and, in relation to digitalis and tobacco, experiment seems to have determined that their influence on the heart is secondary, the same is probably true of all.

Their effects on the system, and therapeutic application, will be most conveniently considered in connexion with the several medicines individually. It will be sufficient here to say, in general terms, that they are indicated both in nervous irritation, and excessive action of the heart, and especially in diseases which combine these two mordid conditions. In inflammation, so far as the mere reduction of the circulation and nervous excitement is required, they are capable of rendering useful service; but as they do not, like bleeding and the arterial sedatives, directly change the character of the blood, they are less efficient as antiphlogistics, and must be regarded rather as auxiliary than as principal remedies.

I. FOXGLOVE.

DIGITALIS. *U.S.*, *Lond.*, *Ed.*, *Dub.*

Origin. This is the product of *Digitalis purpurea*, a beautiful herbaceous, biennial or perennial plant, indigenous in Europe, and cultivated in this country as an ornament of gardens, and to a considerable extent also for use. Both the leaves and seeds possess medicinal virtues, the latter even in greater proportion than the for-

mer; but the leaves only are officinal, being preferred on account of the much greater quantity produced. They should be collected in the second year of the plant, about the period of inflorescence; and only the full-grown and fresh should be chosen. Being injured by an elevated temperature, and by exposure to the air and light, they should be carefully dried by a moderate heat, and kept in well-closed tin canisters, or, if powdered, in glass-stoppered bottles from which the light is excluded. It has been recommended to reject the footstalk and midrib, when they are dried, as these parts are less efficacious than the expanded portion of the leaf; but this caution is often neglected. The leaves should also be dried and preserved separately, and not compressed in the form of those oblong cakes, which are often kept in our shops; for, though the medicine may be of good quality as existing in the cakes, it is liable to be deteriorated, either by the heat employed in drying them, or by the decomposition consequent on the leaves being pressed while moist.

Properties. The leaves, which are attached to the stem by short winged footstalks, are ovate, about eight inches long by three in breadth, pointed, obtusely serrated on their edges, with wrinkled velvety surfaces, the upper of which has a fine deep-green colour, the under is more downy and paler. They are inodorous when fresh, but acquire upon drying a faint narcotic smell. Their taste is bitter and nauseating, and their colour when dried a dull green. In powder they are of a fine deep green. As found in the shops, they are extremely variable in strength, partly from original deficiency, and partly from changes after collection; yet there are few medicines in which uniformity of strength is more desirable; as, being usually administered in small doses at first, to be gradually increased till their effects are experienced, which is sometimes not for several days, much valuable time is lost in the preliminary trial, if they should turn out to be feeble or inert. The best test which the physician can apply is that of the senses. He should take care that only the proper substance of the leaf is used, that it has the green colour without brownish stains, and that the characteristic bitter and nauseating taste should be very obvious. The medicine imparts its virtues readily to water and alcohol. These virtues reside exclusively in a peculiar principle called *digitalin*, which, as it is separated for use, and employed to a considerable extent, will be described among the preparations. By destructive distillation, the leaves yield a poisonous empyreumatic oil, which contains no digitalin.

1. *Effects on the System.*

Digitalis is locally excitant, but powerfully sedative to the nervous and circulatory systems, and stimulating to the function of the kidneys. When the powder is applied to the skin denuded of the cuticle, or to a mucous surface, it causes painful irritation, and, if continued, inflammation, sometimes followed by ulcers. Of course, this locally irritant property is exercised upon the stomach, when the medicine is swallowed in sufficient quantity, and must be taken into account in explaining certain effects of digitalis, which might otherwise be very wrongly interpreted.

Given in the regular medicinal doses, repeated at the proper intervals, and gradually increased if necessary, digitalis is often, as I know from frequent observation, without any apparent effect upon the system for several days. In other instances its peculiar influence is felt in a few hours, and sometimes very speedily. These differences depend partly on difference of strength in the medicine, and partly also on the extremely variable susceptibility to its influence in different individuals. Nor is the character of the effect which is first produced always the same. In some instances its local operation is first evident, in others its action on the kidneys, and in others again its sedative influence on the heart, or the nervous centres. As a general rule, the local effect of the medicine, in the doses referred to, is scarcely felt; at least this is certainly true in the great majority of cases. Most frequently it is either the diuretic action, or that upon the circulation, which is first experienced. Of the former of these I shall treat under the diuretics, and will merely further observe here, that it is often very powerful, and of inestimable service in the treatment of dropsical diseases. It is with the sedative operation of digitalis that we are here concerned. This is usually first evinced in the diminished frequency of the pulse, and afterwards in the production of nervous symptoms.

On the Circulation. The great majority of observers agree in the statement that the first effect of digitalis, in medicinal doses, upon the pulse, is to diminish its frequency. This has been noticed, not only in relation to man, but also in the inferior animals. In some carefully conducted experiments upon the horse, by MM. Bouley and Reynal, of the veterinary school of Alfort, the result in every case, when the medicine was given in a therapeutic dose, was to reduce the frequency of the pulse and the number of respirations,

the former effect generally commencing in eight or ten hours, and continuing for a day or more. (MM. Homolle and Quevenne, *Arch. de Physiol.*, Jan. 1854, p. 223.) In man, when the medicine acts, the greatest amount of reduction usually occurs in from four to six hours after its administration. The degree to which the reduction sometimes takes place is very great. From the natural standard, the pulse not unfrequently falls to fifty in the minute, and instances have been observed in which it has sunk to thirty, and even lower. I have often noticed that, with the diminution in the frequency of the pulse, there is an increase in its volume, but not, as some have stated, in its force. On the contrary, the resistance under the fingers is generally if not invariably diminished, in the normal state of the system; and, if the influence of the medicine is increased, it may become extremely feeble.

It must be acknowledged that a very different account of the effects of digitalis on the circulation has been given by some writers. Thus, Dr. James Sanders, of Edinburgh, who bases his statements upon the observation of 2,000 cases, asserts that the first effect is almost instantaneously to increase the frequency and force of the pulse, which sometimes quickly subsides, sometimes continues excited for several days under the use of the medicine; though ultimately, in the course of a day or two after its exhibition, a reduction of the pulse may take place. (*Treatise on Pulmonary Consumption, &c.*, Edin., 1808, p. 196–7.) No other writer, I believe, has gone so far in this direction as Dr. Sanders; but several others have maintained the primarily stimulant property of digitalis. The vast majority of observers, however, have failed to discover this effect; and, though I have employed the medicine in a very great number of cases, during a practice of nearly forty years, I have rarely noticed any increased frequency, at any time, from the use of it. I do not, however, deny that it may sometimes accelerate the pulse; but much more frequently, when any effect of this kind is observed, it proceeds from some other cause wholly independent of the digitalis; and, when the effect of the medicine, is probably produced through the sympathy of the circulation with the primary irritant impression of the digitalis on the stomach. In the cases noticed by Sanders, the effect on the circulation so quickly followed the exhibition of the medicine, that absorption could not have taken place; and, whatever increase of pulse occurred, if proceeding from the medicine, must have been occasioned by a sympathetic impression extended to the heart, either from

the mouth and fauces, or from the gastric mucous membrane. This view is confirmed by the experiments of MM. Bouley and Reynal on horses, already noticed. It has been stated above that, when the medicine was given to these animals in therapeutic doses, that is, in doses too small to irritate the stomach, it invariably reduced the pulse without any previous acceleration. But when a poisonous quantity was exhibited, some excitation both of the pulse and respiration took place, before the characteristic prostration, which preceded the fatal result. (*Arch. de Physiol.*, Jan. 1854, p. 216, &c.) In these instances, the gastric inflammation produced by the large amount of the poison taken, induced a general febrile condition, antecedent to the characteristic effects resulting from the absorption of the poison. But the strongest experimental proof of the depressing influence of digitalis on the circulation is that produced by Dr. Traube, of Berlin. In several instances the infusion of digitalis was injected into the jugular vein towards the heart; and invariably the pulse was rapidly and greatly reduced in frequency, in one instance falling, in a single minute, from 132 to 24. If, after the injection, the par vagum was cut on both sides, the pulse quickly rose to more than its original frequency; and if the division was made prior to the injection, little or no depression was produced; thus proving that the medicine had no immediate action upon the heart itself, but operated through the nervous centres in the medulla oblongata. But a singular fact was developed by a repetition of the injections successively, until a large quantity had been introduced. Thus, in the same animal in which the reduction above mentioned took place immediately after the first injection, upon its repetition several times, at intervals of a few minutes, the fifth was followed by an extraordinary frequency of the pulse, which rose to 174. By the large quantity, the nervous centre became paralyzed, and thus ceased to be able to transmit the depressing influence to the heart, which was now submissive to the direct stimulant action of the blood, increased by the locally irritant properties of the digitalis. Dr. Traube advances a somewhat different explanation of the results here stated; but they clearly admit of that which I have given, and confirm the view here taken of the direct sedative influence of digitalis on the circulation, through the nervous centre of this function in the encephalon. (See *Lond. Med. Times and Gaz.*, April 21, 1855, p. 381.)

Not unfrequently, the first change in the pulse to be noticed is

intermission, instead of a regular subsidence in frequency. This I have frequently observed: and I always regard irregularity of pulse, occurring after the exhibition of digitalis, unless traceable to some other obvious cause, as an evidence of the commencing action of the medicine upon the circulation.

In other cases, it is impossible to obtain from the medicine its legitimate action upon the pulse, unless pushed further than prudence would warrant. This may be owing to idiosyncrasy in the patient, or to the rapid passing off of the medicine by the kidneys as fast as it enters the circulation, or lastly to a tendency to irritate the stomach, so as in this way either to interfere with absorption, or to counteract by an indirect stimulation the direct sedative influence of the remedy.

It was noticed by Dr. Baildon of Edinburgh, that the influence of digitalis upon the circulation was much affected by posture. The pulse which, in his own case, had, under the influence of the medicine, fallen from 110 to 40 in the recumbent position, was increased to 72 when he sat, and to 100 when he stood. (*Ed. Med. and Surg. Journ.*, iii. 270.) The following explanation of this phenomenon was given by me in the first edition of the U. S. Dispensatory, published in 1833. "It is well known that the pulse is always more frequent in the erect than in the horizontal posture, and the difference is greater in a state of debility than in health. Digitalis diminishes the frequency of pulsations of the heart by a directly debilitating power; and this very debility, when any exertion is made which calls for increased action in that organ, causes it to attempt, by an increase in the number of its contractions, to meet the demand which it is unable to supply by an increase of their force." This I still consider to be the true explanation, with the exception that the medicine should be stated as acting on the heart through its encephalic nervous centre, instead of immediately upon the organ. The result is in perfect accordance with the general views here given of the action of digitalis.

On the Respiration. The depressing effect of the medicine upon the respiratory function, though shown, by the experiments of MM. Bouley and Reynal upon the horse, to accompany in that animal the similar influence on the circulation, has not been so satisfactorily established in reference to man. Experiments upon the subject have led to the conclusion, that the function is sometimes accelerated, but more frequenty diminished; and it would seem that the simple reduction of the heart's action ought to be followed as a

necessary consequence by that of respiration. (*MM. Homolle and Quevenne, ut supra*, p. 316.)

On Temperature. There does not appear to be much more certainty as to the effects of the medicine upon the temperature of the body. While MM. Duméril, Demarquay, and Lecointe found the temperature increased eight times and diminished once in dogs, MM. Bouley and Reynal have noticed a diminution of it in horses from therapeutic doses (*Ibid.*, p. 236), and Dr. Traube states, as the result of his observations, that it lowers the temperature in febrile and inflammatory diseases. (*Arch. Gén.*, 4e sér., xxviii. 335.) In relation to the first series of experiments, it should be stated that they were made with doses of fifteen grains or more of the extract of digitalis; so that, as with the similar experiments with poisonous doses on horses, it might be expected that the temperature should be raised, like the circulation, through the sympathetic effect of the irritation of stomach, before the proper influence of the medicine on the nervous centres could be obtained. So far as I have myself noticed the effects of digitalis in this respect, they correspond with the observations of Dr. Traube. There is no doubt that, in the cases in which it produces great depression of the circulation, with nausea and vomiting, it reduces the temperature in a corresponding degree.

On the Nervous System. All the effects on the circulation above detailed may often be obtained from digitalis without any serious disturbance of the nervous system; but sometimes the influence of the medicine seems to be early directed to the cerebral centres, even in small doses; and, if the quantity be increased after the reduction of the pulse, or if the same doses be continued undiminished, the nervous symptoms become prominent. The first effects of this kind usually experienced is a sense of weight, or stricture, or slight pain in the head, especially over the brow, which is followed by buzzing in the ears, disorder, or dimness of vision, vertiginous feelings, general muscular weakness, and sometimes a tendency to syncope. There is no antecedent mental exhilaration which I have ever been able to discover; and the intellect, instead of being for a time invigorated, as by opium, is weakened, as evinced by the mental confusion, hallucinations, and slight delirium, which often attend the over-action of the medicine. Violent delirium is said to be sometimes induced; but I have never witnessed it. The medicine occasionally causes drowsiness, but this is not an ordinary result. On the contrary, it not unfrequently occasions wakefulness

when taken too largely, or acting with unexpected violence in medicinal doses. A feeling of irritation is sometimes experienced in the pharynx and œsophagus, which may be extended to the larynx, giving rise to hoarseness. But among the most frequent effects of over-doses are nausea and vomiting, which are sometimes excessive, and are now and then attended with purging. The nausea and vomiting are to be ascribed more to an operation on the cerebral centres, than directly on the mucous coat of the stomach; for they are said to be produced when the medicine is introduced into the veins, or into the cellular tissue.

Some writers have ascribed these nervous phenomena to a stimulant operation on the nervous centres; but they seem to have lost sight of the well-known fact, that depression and irritation of the cerebral centres often make themselves known by symptoms in many respects identical, and that neither one nor the other condition can be determined by the phenomena which are common to both. But that the condition of the cerebral functions, as of the nervous system generally, is one of depression, may be inferred from the absence of that temporary elevation of the intellectual and emotional functions which characterize the true cerebral stimulants, from the deficiency of muscular power without anterior increase, from the paleness of face and diminished supply of blood to the brain, and from the general tendency to prostration when the operation of the medicine is in excess.

To the effects upon the nervous centres must be ascribed the remarkable depressing influence of digitalis upon the genital organs, and the sexual propensity, as observed by Dr. Brughmans, of Belgium, and the useful employment of it in certain affections of these organs, as first suggested by M. L. Corvisart, of Paris.

Poisonous Effects. Hitherto I have treated of the effects of digitalis in therapeutic doses. Even from such doses, too rapidly increased or too long continued, the most alarming effects have been frequently experienced, ending sometimes in death. The following are the symptoms usually resulting from a poisonous quantity given at once, or at short intervals. The effects on the stomach and bowels may come on soon after the taking of the poison; those on the nervous system do not generally occur, at least in their greatest intensity, until some hours have elapsed; and it is highly probable that the latter are often in a considerable degree prevented, and life saved, by the evacuation of the poison consequent on the former. Excessive nausea and vomiting with or without purging, griping

pains in the stomach and bowels, thirst and dryness of the throat, hiccough, an extremely feeble, small, irregular, and generally slow pulse, paleness of the surface, cold extremities and universal cold sweats, great muscular relaxation and debility, faintness, headache, vertigo, sometimes delirium, perverted vision, insensibility to light, dilated pupil, cramps and convulsions, sunken features, and ultimately coma, are the phenomena ordinarily present in very threatening or fatal cases. A copious flow of saliva has also been observed; but this is a very frequent attendant on nausea from whatever cause. Death usually occurs after a considerable period, in the greater number of cases, probably, between twenty and thirty hours from the taking of the poison. The appearances after death are marks of inflammation in the stomach and bowels, dark and uncoagulable blood, and a loss of contractility in the heart.

The quantity capable of causing death has not been determined. In general, when fatal results have followed one or a few doses of the poison, the quantity known to have been taken has been indefinite, as, for example, draughts of a strong decoction of the leaves, of a handful of the leaves boiled in water, &c. Poisonous symptoms of the most alarming kind have been produced by a drachm of the powder; but the patient recovered. In *Pereira's Materia Medica*, it is stated that a respectable practitioner of Suffolk, England, was in the habit of giving an ounce of the tincture at one dose, and, if he found no effect at the end of twenty-four hours, of repeating the dose, which then rarely failed to lower the pulse in the desired degree; and this was done not only with safety, but with decided advantage. Sometimes vomiting quickly followed; but never any dangerous symptom. Dr. Pereira himself frequently gave a drachm of the best tincture three times daily for a fortnight, without any marked effect. The tincture, well prepared, contains the virtues of a drachm of the leaves in a fluidounce. These facts are no doubt authentic; but they only prove the great difference of susceptibility to the action of digitalis, and offer no ground for the use of the medicine in so large a dose. I should consider that, after what has been made known of the occasional powerful action of the medicine, a practitioner who should administer an ounce of the tincture at one dose, to an individual not accustomed to its use, would be guilty of manslaughter, should the patient die from the effects of the medicine.

The treatment adapted to poisoning from a large dose of digitalis, if the patient has not vomited, is to administer ipecacuanha till

this effect is produced; if vomiting has taken place, to assist in washing out the stomach by means of copious draughts of warm water or demulcent drinks, to which tannic acid may be added, in order to form an insoluble compound with the active principle. Afterwards, opium should be administered by the rectum or stomach, a sinapism applied to the epigastrium, and the strength supported, if necessary, by whine-whey, carbonate of ammonia, &c.

Permanence of Operation and Cumulative Tendency. There are two circumstances in the operation of digitalis, which, from their practical importance, require particular notice. One of these is the long continuance of its effects, after having been once produced, without its further administration, and the other its tendency to a cumulative operation.

Not unfrequently the reduction of the pulse produced by digitalis, or the increased flow of urine occasioned by it, will continue to a greater or less extent for days, if brought about by the continued use of small doses of the medicine; and, when any decided symptoms appear, they do not subside completely until after seven or eight days or more.

Soon after foxglove came into use, attention was called to its remarkable property, after having been given daily, in small but increasing doses, for a considerable time, without observable effect, of beginning abruptly to act with great energy, as if with the accumulated effect of all that had been previously taken. Alarming instances of this kind were not unfrequently observed; and sometimes fatal effects occurred. Dr. Blackall mentions a case, in which death appeared to be caused by two drachms of the infusion, taken daily for some time. I myself, many years since, witnessed the death of a boy, with symptoms strongly resembling those of poisoning by digitalis, who had for some time been taking the ordinary doses, without effect, for dropsy. Nevertheless, I have no doubt that the danger from this cause has been over-estimated; and many have been deterred from the efficient use of the medicine by causeless apprehension. It is always proper to commence with a small dose, smaller indeed than will be likely to produce any visible effect of itself; because there is in some a most remarkable susceptibility to the action of the medicine. Even two grains have produced alarming symptoms. But with this caution, and due care and watchfulness in the increase of the dose, I believe that the therapeutic influence of the medicine can always be obtained without danger. In regard to its cumulative operation, should no

observable effect have been produced, with gradually increasing doses, by the time that a poisonous quantity has been taken altogether, a drachm of the powder, or a fluidounce of the tincture for example, it would be advisable to suspend the medicine for a few days, and afterwards resume, if thought advisable.

Slow Diminution of Susceptibility. Another fact of value, in reference to the operation of digitalis, is that the susceptibility to its influence decreases slowly; so that, after having ascertained the effective dose, it will not be necessary, as in the case of opium and other cerebral stimulants, to increase it rapidly in order to sustain a given effect.

2. *Mode of Operation.*

After what has been already said, little will be required upon this point. The reader is already aware of my belief that digitalis is a local excitant, and that, when given in large doses by the stomach, it is capable of irritating or even inflaming that organ, and thus of producing a general sympathetic excitement, attended with increased frequency of pulse and heat of the body; but that, when taken in quantities insufficient to irritate the stomach, it is in no degree capable of exciting the heart, or augmenting the temperature. He is also aware, that I consider the essential effects of the medicine upon the system generally, to be sedative to the nervous centres and the circulation, and to the latter through its influence on the former. There can be no doubt that these effects are produced through absorption. It is true that the active principle of digitalis has not been discovered in the urine; but the proportion of digitalin is so exceedingly minute, in relation to the effect produced, that this should not be expected. The proof of absorption is afforded by the facts, that, when injected into the cellular tissue, it is capable of producing the same effects as when exhibited by the stomach; that its diuretic operation has been induced by its application to the surface of the body; and that, when introduced into the blood-vessels, it acts in the same manner as when brought in other modes into contact with the body, though more rapidly. The evidence of its primary influence upon the nervous centres, and through them on the heart, is afforded by the fact already stated that, if the par vagum be divided on both sides, it ceases to reduce the heart's action, and in moderate quantities produces no effect upon it. The dark and liquid state of the blood, and the loss of contractility of the heart, are probably due also to an influence exercised upon these two vital constituents of the system through the encephalic centres.

3. *Therapeutic Application.*

Digitalis has been known as a medicine from the earlier modern times; though the ancients were probably altogether ignorant of its powers. It was recommended in scrofula by Van Helmont and Boerhaave, and is said to have held a place in the London Pharmacopœia in 1721, though afterwards excluded. It never, however, was in general use; and attracted little attention from the profession, until the appearance of Dr. Withering's monograph in 1775, recommending it as a most valuable remedy in dropsy. Its important sedative properties were soon developed; and, both as a diuretic and a sedative, it now takes a rank inferior only to a few of our most esteemed medicines.

Digitalis is indicated, as a sedative, whenever inordinate action of the heart is to be reduced, or high nervous excitement to be allayed, provided that time be allowed for the safe employment of the remedy. It is contraindicated in debility of the heart, and prostrated states of nervous power; and hence is hazardous near the close of exhausting diseases, though it might seem to be called for by frequency of the pulse and nervous disturbance. Nor, in consequence of its slow action, can it be relied on in cases, in which an immediate and energetic impression upon the nervous centres, or upon the heart is required. It is also contraindicated when there is high vascular irritation or inflammation of the stomach.

Inflammation. This affection would appear to offer obvious indications for the use of digitalis, both from the circulatory and nervous excitement which enters into its constitution; and the sedative powers of the medicine had no sooner been determined, than attention was strongly directed to it as a means of cure in this affection. It was, indeed, hoped that it might prove a substitute for the lancet, and thus cure the disease without debilitating the patient. Experience, however, soon disappointed these beautiful expectations; and digitalis was found not to be a reliable remedy in inflammation. The reason of this is obvious. It is not solely a reduction of the circulation, or of nervous excitement, that is wanted in this pathological condition. There is an indication, also, for altering the character of the blood. This is done by bleeding, the antimonials, and other arterial sedatives; and this is what digitalis fails to do. Another objection to relying upon it, in the phlegmasiæ, is the frequent necessity for a promptness of treatment to which digitalis is unsuited, because hazardous, if used in large doses with a view to immediate effect. While we are cautiously administering the remedy, and watching for the effects of its repeated

doses, the time for efficient interference often passes, and its influence may thus come too late. Nevertheless, it is sometimes very serviceable in inflammatory diseases, as an adjuvant to other measures, or even as a substitute for the lancet, when this could not have been employed, or can be employed no longer. Whenever, in these diseases, there is an indication for reducing the pulse, and the blood is too much impoverished to admit of further change, but yet not so depraved as to be unfit for the support of the functions, as it is in the typhoid state, then digitalis may be given, and will not unfrequently prove useful. Another condition often attendant on inflammation calls specially for this remedy. I allude to serous effusion, of which digitalis powerfully promotes the absorption, partly perhaps by depressing the pulse, but chiefly by its diuretic action. Unless there is frequency of pulse to be subdued, with a condition contraindicating the loss of blood, or serous effusion which it is desirable to remove by absorption, this medicine is of little use in the phlegmasiæ; when these two conditions are conjoined, it is often highly serviceable.

In *pneumonia*, it has been recommended either in one large dose, so as to bring the system promptly under its depressing influence, or in very minute doses repeated every hour, till the same effect is produced; but we have, I think, safer and much more reliable means for accomplishing the same object; and I do not, therefore, think the treatment advisable.

But in *pleurisy* and *pericarditis*, with copious effusion, especially in their advanced stage or chronic condition, digitalis is often very useful, particularly in connexion with calomel. Squill often also answers the same purpose, as regards the absorption of the liquid, but it is less suitable than digitalis, when there is a frequent pulse requiring reduction. In cases where the choice between digitalis and squill is doubtful, the two remedies may be given conjointly, and both often with calomel.

In *meningeal inflammation*, especially in children, the same indication often exists; much of the danger here being attributable to the pressure of the effused serum upon the brain.

Acute rheumatism often calls for digitalis, in that anemic condition in which bleeding is inappropriate, and especially when conjoined with pericardial or endocardial inflammation. Under these circumstances, it is all-important to quiet the heart, the movements of which are acting as a perpetual source of irritation to the inflamed membranes. It may here in general be usefully associated with calomel, and almost always with nitre.

Scrofulous inflammation is often attended with a frequent pulse, which it is generally not permitted to reduce by bleeding, and in which even the antimonials may be contraindicated, either by their tendency to nauseate, or their effect in impairing the blood. Digitalis may be usefully employed in these cases, in connexion with the appropriate tonics and alteratives. It has already been stated, that scrofula was the complaint in which digitalis was first used.

Fevers. In the febrile state, not less than in the inflammatory, there would seem to be an indication for the sedative effects of digitalis on the heart and nervous system; but experience has not pronounced more decidedly in its favour, in the idiopathic fevers, than in the phlegmasiæ. Something more than a reduction of the pulse is necessary here also; and, in the highest stage of excitement, digitalis would generally fail to produce even this effect, unless in hazardous doses. When, however, the violence of the disease has abated, while the pulse remains very frequent, digitalis may sometimes be usefully employed, if there be no typhous complication present. It is peculiarly applicable, in connexion with tonics, to those cases of imperfect convalescence from fever in which the pulse continues obstinately frequent.

In *intermittent fever*, the remedy has been employed by Bouillaud and others, as an antiperiodic, with asserted success; but it is, to say the least, of doubtful efficacy, and should not be confided in to the neglect of the cinchona alkaloids.

I think I have found considerable benefit from digitalis in *scarlet fever*, in which the extraordinary frequency of the pulse is one of the most prominent symptoms. I have not, however, used it in the cases of young children, and do not consider it applicable to the malignant form of the disease.

Active Hemorrhage. In all cases of active hemorrhage, except that from the stomach and bowels, in which its local irritating property might prove hurtful, there is an indication for the use of digitalis, when the patient is too weak to justify bleeding, and the pulse is very frequent. It may, under such circumstances, be appropriately combined with acetate of lead, or other astringents.

Phthisis. At one time digitalis had a high reputation in phthisis; and great success was apparently met with, in the cure of the disease, by its use. The journals teemed with favourable reports of its efficiency. It is needless to say that, with the imperfect means then existing of diagnosticating thoracic diseases, chronic catarrh and other affections of the chest were not unfrequently confounded with genuine tuberculous consumption, and that the

cases cured belonged in all probability to the former category. No one now expects to cure phthisis with digitalis, or even materially to modify the diathesis upon which the deposition of tubercles depends. All that can be expected from it is to control, in some degree, the excessive frequency of the pulse characteristic of the disease, to allay nervous irritation, and to diminish night-sweats, or promote absorption, by its diuretic influence; and these effects can probably be obtained in general as well by other measures, less liable to disturb the digestive organs, which it is important to keep in as healthy a state as possible. Still, there are occasions, in the course of phthisis, in which the remedy may be advantageously resorted to as a palliative, especially to quiet the action of the heart, and favour the absorption of effused liquid, though caution is necessary to prevent the prostrating effect of over-doses.

Disease of the Heart and Arteries. Perhaps in no affection does digitalis act more happily, as a sedative, than in diseases of the heart. It is called for in these complaints, whether functional or organic, whenever the heart beats too strongly or too frequently, provided, in the latter case, the frequency is not a pure result of debility. Notice has already been taken of its use in endocarditis and pericarditis.

In *hypertrophy of the heart, without valvular disease*, and the pure result of cardiac irritation, it is an admirable remedy, in connexion with a due amount of depletion, rest, and low diet. In this affection, the heart should be kept under its influence for a long time; the remedy being only occasionally intermitted for a few days, in order to prevent serious consequences from accumulation. A longer intermission than a week, on this account, is never necessary; and, at these times, the place of digitalis may be supplied with some other one of the nervous sedatives, especially hydrocyanic acid.

In *hypertrophy, with valvular disease, and dependent upon it*, the remedy is less beneficial; because the overgrowth of the muscle is usually a provision of nature, under these circumstances, to regulate the movement of the blood, disturbed by the deranged state of the valvular openings. To illustrate my meaning, I would merely adduce the instances of constriction of the aortic orifice, and imperfect closure of the mitral valves; in the former of which the left ventricle becomes hypertrophied, in order that it may compensate, by the force of the current of blood sent from it into the system, for the deficiency of its volume; while, in the latter, a similar result takes place, in order that the loss to the body at large of the portion of blood regurgitating with each ventricular contraction, may

be counterbalanced by the greater capacity and vigour of the ventricle. In each of these cases, all the functions would suffer from a defective supply of blood, were it not for the hypertrophy; and whatever tends to depress the cardiac action, must just so far diminish this counteracting influence, and impair the general health. The principle, in these cases, is to employ digitalis only when the action is in excess; in other words, when the general functions suffer, in consequence of a larger supply of blood than they require for their healthful performance.

In *dilatation of the heart*, which is generally associated with anæmia, and in which the tissue of the heart itself is probably enfeebled by defective nutrition, the use of a sedative agent would seem to be contraindicated; and certainly it is necessary to exercise caution in the use of digitalis in this affection. But when, as often happens in dilatation, the heart acts excessively under the irritation sent to it through the nervous centres, from the insufficiently supplied functions, and by this very excess of action is exhausted and still further weakened, digitalis may often be given with great benefit, if accompanied with chalybeates, the mineral acids, or other tonics, in order to improve the character of the blood. An important incidental advantage, in these cases, is frequently its effect in removing the dropsical effusion, whether in the pericardium, the other serous cavities, or the general areolar tissue, which so frequently complicates them.

Functional palpitation of the heart, either from plethora, anæmia, or mere nervous disorder, is often more or less benefited by digitalis; but the remedy is applicable only to the cases in which the affection has a certain degree of permanency, and not at all to those occasional and fugitive attacks which occur under passing excitements, and are so common in hysterical women, and nervous persons in general. For these it is not sufficiently quick in its action, and is much inferior to the nervous stimulants, which operate by equalizing excitement. Whenever digitalis is exhibited, in the more enduring cases of palpitation, it should be associated with measures calculated to remove the cause; as otherwise it will be of little comparative service, merely repressing the cardiac excitement, without correcting the conditions of system of which that excitement is intended to be an index, and sometimes even a remedy. In plethoric cases, therefore, it should be accompanied with measures for diminishing the quantity and lowering the quality of the blood, and, in the anemic, with others of an exactly opposite character.

In *aneurisms* generally, and particularly in *aneurism of the aorta*, digitalis sometimes proves serviceable by lessening the distending effect of the heart's contraction, when the circulation is too vigorous or too much excited. It acts, however, only as a palliative.

Nervous Diseases. Sufficient has already been said of the use of digitalis in palpitations of nervous origin. It has been recommended in some spasmodic affections, as *epilepsy* and *spasmodic asthma;* and may have occasionally proved serviceable in these diseases; but it is inferior to many other remedies more commonly employed; and is peculiarly indicated only when the spasmodic disease is attended with a prevalent abnormal frequency of pulse. In *delirium tremens*, in which it has also been recommended, it is of more doubtful propriety; for, though it may sometimes beneficially reduce the circulation when excited, there would always be danger of inducing prostration, which, in this affection, when uncomplicated with meningeal inflammation, is, I believe, the chief source of danger. *Acute mania*, when attended with cerebral and cardiac excitement, and especially when depletory measures may be deemed inappropriate, and the cerebral stimulants are not admissible, may sometimes be advantageously treated with digitalis.

Allusion has been made above to the antaphrodisiac property, said to be possessed in an extraordinary degree by this medicine. In April, 1853, the attention of the profession was called, by M. L. Corvisart, in a communication contained in the *Union Médicale*, to several cases of *spermatorrhœa*, which had either been cured or benefited by this remedy, given in the ordinary doses through the day. (*Ann. de Thérap.*, 1854, p. 50.) This favourable report of it was afterwards confirmed by Dr. Brughmans, in the *Journal de Médicine* of Brussels (Nov. 1853), who found it extremely useful, not only in the affection mentioned, but also generally in erethism of the genital organs, such as attends gonorrhœa and chancre; and, from his account, it may be inferred to be equally applicable to the irritations and inflammations of these parts from other causes. (*Journ. de Pharm. et de Chim.*, Fev. 1854, p. 152.) Still later (Oct. 1854), a case of severe spermatorrhœa is related by M. Laroche, in the *Gazette Médicale*, which was cured by the remedy in three weeks. (*Lond. Med. Times and Gaz.*, Nov. 1854, p. 473.) Should it be found to fulfil the expectations which these reports in its favour are calculated to excite, it would prove a most valuable remedy, even though possessed of no other recommendation.

4. *Administration.*

In cases admitting of delay, one grain of the powdered leaves may be given, in the form of pill, twice or three times a day, and increased every other day by one-quarter or one-half of the dose, until its effects are experienced, or until from two scruples to a drachm shall have been taken, when, should it have produced no sensible effect, it should be suspended for a few days, for fear of a cumulative operation, and afterwards resumed. When it begins to operate, the dose for a like reason should be diminished, so as simply to maintain its influence; and, if nausea and vomiting, or great prostration are produced, it should be suspended; to be resumed, in a smaller dose, when these effects have subsided. If these rules are observed, I believe that it may always be given with safety.

In acute cases, as for example in inflammatory rheumatism or pericarditis, a grain may be given every four or six hours, its effects being closely watched.

The officinal *Infusion* (INFUSUM DIGITALIS, *U.S.*) is prepared by macerating a drachm of the leaves in half a pint of boiling water, and adding a fluidounce of tincture of cinnamon. The dose of this preparation, usually recommended, is half a fluidounce; but, if the infusion is well made, this would be out of proportion to the dose of the powdered leaves. Two fluidrachms are as much as should be given for a commencing dose. It may be repeated, and otherwise regulated, as advised for the pill.

The *Tincture* (TINCTURA DIGITALIS, *U.S.*) is made in the proportion of four ounces to two pints of diluted alcohol. The dose of this, equivalent to a grain of the powder, is eight minims, or about sixteen drops, to be repeated and increased as directed for the pill. As found in the shops, the tincture is not unfrequently feeble, being prepared probably from inferior leaves, or from the leaf, midrib, and footstalk mixed together. It should have a dark colour, and a very bitter taste.

DIGITALIN.—This is the active principle of digitalis, first obtained separate by M. Homolle, of France, and abundantly proved by the experiments of MM. Homolle and Quevenne, to concentrate in itself all the virtues of the medicine.* It is prepared, as recom-

* Unfortunately, the discoverer conferred upon it the name of *digitaline*, reserving that of *digitalin* for another peculiar principle contained in the leaves, which, however, is quite inert. According to the English pronunciation of these words, there is too little difference in their sound to admit of the retention of them both; and I therefore use the term *digitalin* to express the active principle, which is in accordance with the nomenclature for substances of this kind adopted in the U. S. Dispensatory.

mended by these authors, in their elaborate treatise on the subject, published in *Bouchardat's Archives* (Jan. 1854), by forming an infusion, precipitating inert matter by subacetate of lead, precipitating the excess of the salt of lead by carbonate and phosphate of soda, separating the lime contained in the infusion by oxalate of ammonia, and then treating the filtered liquor with tannic acid. This forms with the digitalin an insoluble compound, which is mixed with protoxide of lead, then dried, and treated with alcohol. The oxide of lead separates the tannic acid, and the digitalin is dissolved by the alcohol, from which it is separated by distilling off the latter. It is purified from accompanying substances by means of highly concentrated ether, which leaves the digitalin sufficiently pure for use.

Digitalin is in the form of a slightly yellowish powder; scarcely crystallizable; unalterable in the air; of a feeble, peculiar, aromatic odour; sternutatory when brought near the nostrils; of a taste intensely bitter, but slowly developed in the mouth; soluble in about 2000 parts of cold, and 1000 of hot water; very soluble in alcohol and chloroform, but very slightly so in concentrated ether; fusible by heat, but not volatilizable without change; inflammable; and neuter in its relations to acids and alkalies. It contains no nitrogen. Its characteristic property is that of forming a green solution in concentrated muriatic acid.

As it is a perfectly well characterized principle, capable of being prepared of definite strength, possessing all the medical virtues of digitalis, and producing, as shown by numerous observations, precisely the same effects as that medicine, both in health and disease, it would form an excellent substitute for it, and has been used for the purpose to a very considerable extent. Its advantages over the leaves, and their officinal preparations, are the uniformity of its strength, and its facility of administration. According to MM. Homolle and Quevenne, it is most advantageously given in the form of minute pills or globules, in which the medicine is enveloped in a coating of sugar, so as to cover its taste. Upon the same authority, one part of it is equal to 50 parts of good digitalis, and 75 parts of that medicine of medium quality. Each globule, as prepared by them, contains one milligramme (about $\frac{1}{65}$ part of a grain) of the digitalin, and five centigrammes (about $\frac{3}{4}$ of a grain) of sugar, and may be considered as representing a grain of digitalis. The dose, therefore, is one globule, to be given twice or three times a day, and managed in other respects as recommended above for the powdered leaves. A tincture of digitalin, prepared by dissolv-

ing one grain in a fluidounce of alcohol, would have the average strength of good tincture of digitalis, and might be given in the same dose.

Attempts have been made to employ both digitalis and digitalin by the endermic method; but they occasion so much irritation in the denuded surface, that their use in this way is inconvenient.

II. TOBACCO.

TABACUM. *U.S., Lond., Ed., Dub.*

Origin. Tobacco consists of the leaves of *Nicotiana Tabacum*, a well-known, annual plant, indigenous in tropical America, and cultivated in most civilized countries, but nowhere so extensively as in the United States. All parts of the plant have medicinal properties; but the leaves only are officinal. These are cut in August, dried under cover, and then tied in bundles, in which condition they come into the market. By drying, they acquire an odour not before possessed, and are probably somewhat modified in other respects.

Properties. Dried tobacco leaves are yellowish-brown, of a peculiar strong narcotic odour, and a bitter, acrid, nauseating taste. They impart their virtues to water and alcohol. These virtues are destroyed or dissipated by long boiling; so that the extract is nearly inert.

Active Principles. There are two active principles in tobacco, *nicotia* and *nicotianin*, the former an organic volatile alkali, the latter a concrete volatile oil. It is the nicotia upon which the powers of the medicine mainly depend.

Nicotia was discovered by Vauquelin; but was first obtained quite pure by MM. Henry and Boutron. It exists in the leaves combined with an excess of some organic acid, and becomes fixed by this combination. In the process for procuring it, employed by the chemists last mentioned, the native salt as it exists in the leaves, is decomposed by means of soda, and the nicotia then separated by distillation. As the alkaloid comes over, it is received in sulphuric acid diluted with water, from which it is again separated, in a purer form, by the addition of soda, and another distillation. As thus obtained, it is still mixed with water and ammonia, the latter of which is separated along with it from the leaves. From these impurities it may be freed by placing it under the receiver of an air-pump, and exhausting the air.

It is a colourless or nearly colourless liquid, somewhat heavier than water, having little odour when cold, very irritant to the nostrils when heated, of an exceedingly acrid taste, entirely volatilizable, inflammable, soluble in water, alcohol, ether, and the fixed and volatile oils, of a strongly alkaline reaction, and capable of forming salts with the acids, most of which are crystallizable, and have the acrid taste of their base. It contains no oxygen, but an unusually large proportion of nitrogen; consisting of 2 equivalents of nitrogen, 20 of carbon, and 14 of hydrogen. Tobacco contains from two to about eight per cent. of it, according to the quality.

Nicotianin is procured by distilling the leaves with water. It concretes upon the surface of the water distilled, in the form of a fatty matter. It is volatile, with the odour of tobacco smoke, and somewhat bitter. One grain of it occasions giddiness and nausea when swallowed; but the proportion contained in tobacco is too small to contribute materially to the effects of that medicine. The probability is, that it is developed in the drying of the leaves, and that it is the odorous principle of the drug.

Tobacco yields by destructive distillation an *empyreumatic oil*, which may be obtained colourless by rectification, but becomes brown by time, and, as usually found in the shops, is dark-brown or almost black, and of a thickish consistence. It has an acrid taste, and precisely the odour of old tobacco pipes. Two drops of it killed a dog. It is, therefore, very poisonous; but, according to the experiments of Brodie, it acts in a manner quite different from tobacco, and must consequently contain an energetic principle not pre-existing in the plant. It is said to contain nicotia.

1. *Effects on the System.*

Tobacco is locally excitant. Applied to the mucous membranes, or the denuded cutis, it produces more or less irritation. Thus, in the nostrils it occasions sneezing and increase of secretion, in the mouth an acrid taste, and copious flow of saliva, in the throat a peculiar sensation of acrimony and heat, in the stomach a feeling of warmth, and afterwards nausea and vomiting, and in the rectum often purging. Its general action is that of a powerful sedative to the nervous system, and through that to the circulation. It often also operates as a diuretic. The effects produced by it upon the system are of the same character, to whatever surface it may be applied.

When so employed as to act moderately on the system, without nauseating, it produces an agreeable tranquillizing effect, with feelings of

delicious languor and repose, which have rendered it a favourite article of luxury in all parts of the world. With this general nervous quietude, there is a slight peculiar impression on the brain, for which there is no adequate name, and which only they who have felt it can appreciate. Notwithstanding, however, this feeling of calmness and repose, there is in general no tendency to drowsiness; but, on the contrary, a disposition rather to wakefulness; and persons accustomed to the use of the drug, often resort to it as a means of overcoming heaviness, and facilitating the performance of intellectual tasks, requiring concentration of thought. From this effect, tobacco has been considered by some as stimulant to the brain. I am disposed to look upon the effect as the result of a slight sedative operation, which quieting all the little nervous uneasinesses and consequent distractions to which most persons are liable, enables them to fix their attention upon the subject before them. It is quite different from the exhilaration and temporary invigoration of opium and alcohol; and, when augmented in degree, diverges still more from the effects of those cerebral stimulants, and is indeed in direct opposition to them. Hence, opium and alcohol are among the best counter-agents to the excessive influence of tobacco; which could not happen, if the latter were also stimulating to the brain.

When a person unaccustomed to the use of tobacco, takes it even in small quantities, the effect above mentioned is deepened into vertigo, nausea, and often vomiting, with feelings of epigastric uneasiness, general weakness, universal muscular relaxation, depression of the pulse, coolness of the surface, faintness, &c., which are anything but agreeable, and which are obviously the result of a sedative operation. After a few trials, however, the susceptibility of the nervous centres is diminished, and only the slighter effects above referred to are experienced.

There appears to me to be a considerable analogy between the influences which produce sea-sickness and the operation of tobacco. The first impression of the vessel, gently moving over the waves, is of the same soothing and tranquillizing character, with the same peculiar cerebral sensation; but, in the unaccustomed, this is soon aggravated into vertigo, nausea, and vomiting, with all the anxiety, epigastric distress, and sense of general weakness, that characterize the action of tobacco.

Poisonous Effects. Tobacco often produces alarming effects in over-doses, and has in many instances caused death. This rarely happens from the medicine taken into the stomach, because it is

speedily rejected by vomiting. But death has often resulted from its exhibition by the rectum in the form of infusion, and Desault witnessed fatal effects from the smoke administered in the same way. A case is on record in which the juice of the fresh leaves, applied to the head of a boy of eight years, for the cure of tinea capitis, caused death in three hours; and alarming symptoms have frequently followed the application of the medicine, in various forms, to wounds and ulcerated or abraded surfaces. The smoking of tobacco in great excess has also proved fatal.

The symptoms produced by over-doses of tobacco are excessive and distressing nausea and vomiting, with frequent retching, and a sense of sinking at the epigastrium; occasionally purgation; giddiness, mental confusion, dimness or perversion of vision, and sometimes delirium; muscular weakness, tremors of the limbs, and universal relaxation; feelings of faintness, with great depression of the pulse, which is sometimes slow, sometimes frequent, but always small, extremely weak, and irregular; paleness and coldness of the surface, with cold sweats; and, towards the close of fatal cases, paralysis, drowsiness or torpor, universal prostration, and sometimes, though rarely, convulsions before death. The fatal result may be very speedy, having sometimes occurred in less than an hour, though more frequently after several hours.

In the *treatment of poisoning by tobacco*, the first indication is to remove the cause. Hence, if it has been swallowed, the stomach should be washed out by demulcent drinks; if administered by the rectum, this should be evacuated by a large purgative enema; if applied to the surface, it should be immediately removed, and the surface cleansed. Opiates should be administered by the mouth or the rectum, a sinapism applied to the epigastrium, and heated rubefacients to the extremities; and, if the prostration is very great, recourse should be had to the alcoholic and ammoniacal stimulants.

Effects of Habitual Use. The habitual use of tobacco by smoking, chewing, or snuffing, if indulged in moderately, is not generally productive of any obvious injury to the health; but, in some individuals of nervous temperament, or great susceptibility of the nervous system, it cannot be employed even in small quantities without injury. In excess, I have no doubt that it is often very injurious, greatly impairing the vigour of the nervous system and of the health generally, and probably shortening life, if not directly, at least by rendering the system less able to resist noxious agents. The effects

most frequently induced are *dyspepsia*, *defective nutrition*, *paleness and emaciation*, *general debility*, and various *nervous disorders*, of which the most frequent are *palpitations of the heart*, *hypochondriacal feelings*, and *neuralgic pains*, especially of the head and eyes. Very great habitual excess seems to be capable of directly inducing a condition, similar to that induced by the omission of alcoholic drinks in the case of the drunkard; a condition prominently marked by muscular tremors, obstinate wakefulness, and hallucinations. The late Professor Chapman informed me that he had witnessed several cases of delirium resulting from tobacco, closely resembling delirium tremens, which ceased upon the omission of the drug. This fact very strongly illustrates the opposite effects of tobacco and alcohol: a condition being produced by the direct influence of the one, very analogous if not identical with that resulting from the omission of the other. Even insanity has been ascribed to the abuse of tobacco. Snuffing appears to be less injurious to the general health, than either smoking or chewing; but there can be no doubt that it is more or less hurtful in excess, and at all events it is apt to occasion diminished susceptibility of the sense of smell, and a disagreeable alteration of the voice.

2. *Method of Operating.*

The sedative effects of tobacco are undoubtedly, I think, produced through the absorption of its active principle. The proof of this is that it operates in the same manner to whatever surface it is applied, whether that of the stomach, the rectum, the skin, or a fresh wound. Thus, two drachms of tobacco, applied to a wound, killed a dog in an hour. The slightly excitant effect, sometimes noticed in the increase of the pulse, and of the temperature, may be reasonably ascribed, as in the case of digitalis, to a sympathetic extension of the local irritation produced by it. That the primary general operation is upon the nervous centres, is to be inferred from the celebrated experiments of Sir B. Brodie upon dogs. An infusion of tobacco, thrown into the rectum, caused death in an hour by paralyzing the heart. But, if the animal were decapitated, and respiration sustained artificially, the poison produced no effect upon the circulation, though it must have equally entered the system. That death results from a cessation of the action of the heart, and not of respiration, as in the case of cerebral stimulants, is shown by the fact, noticed by Brodie, that, after apparent death, that organ was found perfectly quiescent. The em-

pyreumatic oil seems to act differently; for, upon the same authority, the heart, after apparent death from that poison, was, on opening the body, observed to be beating with regularity and vigour. From what has been stated of tobacco and digitalis, the reader must have noticed a strong analogy between them; the most striking difference being, that tobacco has less effect in lowering the frequency of the pulse, and digitalis in producing nausea and vomiting.

3. *Therapeutic Application.*

Tobacco is said to have been first introduced into Spain by Hernandez of Toledo, not very long after the discovery of America. It was sent to France by John Nicot, from Portugal, about the year 1560, whence the name of Nicotiana, conferred upon the genus. It was taken to England upon the return of the fleet under Sir Francis Drake from Virginia, in the year 1586.

The use of tobacco as an emetic, diuretic, errhine, and sialagogue, I shall treat of hereafter. In the present place we are to consider it as a sedative. It might possibly be employed, to a considerable extent, for the same purposes as digitalis; but its great liability to produce nausea and vomiting has very much limited its use as a sedative; and it is at present employed almost exclusively for the production of muscular relaxation, which this very nauseating tendency favours. It appears to possess some degree of anæsthetic power, for which it is occasionally though rarely used. The complaints in which it is most employed are those characterized by spasm, whether of the voluntary or the involuntary muscles. In consequence of its emetic action when taken into the stomach, it is almost never administered in that way for its sedative effects; being usually applied by enema, by inhalation, or externally.

Strangulated Hernia. Probably tobacco has more reputation in the cure of this affection than for any other purpose. It is certainly often very effectual, and has in many instances spared the necessity for the operation. It is used in the form of enema, and acts by inducing complete muscular relaxation, and possibly also by reducing the capillary circulation, and thus lessening the bulk of the strangulating structure. The plan recommended by the late Dr. Physick was to inject half a pint of the officinal infusion, containing a drachm to the pint, and, if this did not answer the purpose in half an hour, to repeat the dose.

Obstinate Colic.—Ileus. When colic has resisted the ordinary measures for producing relaxation, tobacco is often resorted to, and has in its favour the recommendation of the highest medical authori-

ties. It is particularly in cases of ileus, or those attended with stercoraceous vomiting, that it has been recommended; but there is nothing in this particular phenomenon which specially calls for its use, except in so far as it indicates great violence or obstinacy in the affection. In *obstinate constipation* from an unknown cause, whether attended with spasm of the bowels or not, tobacco may be tried among other measures for obtaining relief. It has been recommended also particularly in *colica pictonum;* but it is not so much spasm, as a neuralgic and paralytic state of the bowels, that is to be overcome in this affection; and, as there are other remedies more efficacious for these purposes than tobacco, it is comparatively little used. In all the above cases, the remedy is most conveniently used in the form of infusion, administered by the rectum. The smoke, thrown up the bowels, has been thought by some to be more efficacious, as it may make its way higher up the canal, and thus extend its influence more widely; but it is less by a direct influence on the bowels that the medicine acts, than through the general relaxation, consequent on its absorption and operation on the nervous centres; and, in this respect, an equal effect may be obtained by the enema, which is besides much more convenient and manageable. Dr. Graves, of Dublin, and others before him, have found advantage, in *colica pictonum*, from the application of tobacco to the abdomen externally, by means of compresses of linen soaked in a strong decoction.

Spasm of the neck of the bladder, or of the urethra, with consequent retention of urine, may often be relieved by tobacco, employed either by injection into the rectum, or in the form of a warm cataplasm to the perineum. The same remedy has been recommended in dysury or strangury; and, in the form of cataplasm just referred to, may be tried with propriety; but, as an enema, laudanum is both more efficacious, and attended with less risk of unpleasant if not serious effects.

In *spasm of the glottis*, whether attendant upon inflammation in the adult, or in the form of *croup* in children, tobacco is sometimes of great service. In the latter affection, it was recommended by the late Dr. Godman, in the form of snuff rubbed with simple cerate, and applied to the surface of the throat and chest. The late Professor Chapman found the smoking of a cigar useful in the same disease. I have used the remedy in the shape of the leaves, soaked in hot water, and placed warm and soft about the throat, as a cataplasm. In an instance of most violent and obstinate spasm of the

glottis, in an adult female, immediate relaxation was produced in this way, after failure with depletory and other measures.

In the *paroxysm of spasmodic asthma*, the smoking of tobacco occasionally affords relief, especially in those who have not lost their susceptibility to its effects by habit.

Tetanus is among the affections in which the medicine has been used advantageously. Curling considers it one of the most effectual remedies in that disease, and thinks that more evidence exists of its efficiency than of that of any other single measure. It is usually administered by enema; but has also been employed in the form of a bath, made with a decoction of the fresh leaves. The former method is probably as effectual, and is more convenient.

Hysterical convulsions have been treated by tobacco enemata, and by cataplasms of the same to the abdomen.

It may be employed, in surgery, to *produce relaxation*. Dr. Physick used to relate, in his lectures, the case of a female patient, with obstinate dislocation of the jaw, which could not be reduced by ordinary means. It was important to induce complete muscular relaxation. The state of her health forbade a resort to bleeding for the purpose. He determined, therefore, to bring about the effect by alcoholic intoxication; but found, very much to his surprise, after she had taken a pint of gin, that the object was not attained. Under these circumstances, he gave her a cigar to smoke. Before she had consumed it, she fell from her chair completely relaxed; and, seizing the opportunity, he succeeded in reducing the luxation.

As *an anodyne*, tobacco cataplasms have been found useful in *rheumatic and gouty inflammation of the joints*, *toothache*, and *neuralgic affections* of the forehead and temples. The smoking of a cigar or pipe also sometimes affords relief in the latter affections.

Externally tobacco has been used as a remedy in tinea capitis, psora, and other cutaneous eruptions; being employed either in the form of the fresh juice, infusion, or ointment. It is not impossible that it may prove serviceable, in those cases in which the disease is dependent on a parasitic fungus or animalcule, by destroying the cause; but much caution is requisite in its use, especially in children, when the skin is abraded.

4. *Administration.*

Tobacco will usually vomit in the dose of six grains in a person unaccustomed to it. It is, however, almost never used by the stomach for the purposes above mentioned.

The *Infusion* (INFUSUM TABACI, *U. S.*; ENEMA TABACI, *Lond.*, *Ed.*, *Dub.*) is made, according to the directions of the U. S. Pharmacopœia, in the proportion of a drachm to a pint of boiling water. The British Pharmacopœias generally direct less. It would be best always to adhere to our own officinal formula, for the sake of uniformity, and to prevent mistakes. The preparation is used only for injection into the rectum. One-third or one-half of the quantity may be administered at once, and repeated, in urgent cases, at intervals of half an hour or an hour, until some effect is produced. Instances of death are on record from two drachms, a drachm, and even half a drachm of the leaves administered in this way. The remedy is generally used in very dangerous cases; and I suspect that the death ascribed to it has, in some instances, really resulted from the disease. I have never seen, nor, in this country, heard of fatal, or even alarming effects from so small a quantity as half a drachm; though the remedy should never be administered without the most watchful care on the part of the practitioner.

The *smoke* is inhaled by means of a pipe or cigar. For its introduction into the rectum various instruments have been invented. One of the simplest is that of Gaubius, which consists of a pair of common bellows, with the muzzle covered with leather so as to avoid injury to the bowel. The smoke is introduced into the bellows through a funnel.

For *cataplasms*, a strong decoction, made with an ounce of the leaves to a pint of water, may be mixed up with an emollient substance, as flaxseed meal; or the powder may be similarly incorporated; or, finally, the dried leaves may be steeped in hot water till softened, and then applied moist, and gently pressed together, upon the part.

The *Empyreumatic Oil* (OLEUM TABACI, *U. S.*) is sometimes employed in cutaneous eruptions, indolent or painful tumours, and ulcers, in the form of an ointment, made by rubbing twenty drops of it with an ounce of simple ointment. It should be used with great caution upon ulcerated or abraded surfaces.

An *Ointment of Tobacco* (UNGUENTUM TABACI, *U. S.*) is made by boiling the fresh leaves in lard. It is sometimes used in irritable ulcers, and cutaneous eruptions; but requires caution, as in the last mentioned preparation.

III. LOBELIA. *U.S.*

Origin. *Lobelia inflata, or Indian tobacco,* is a small, annual or biennial, indigenous plant, growing abundantly in most parts of the United States. Though the seeds are the strongest portion, the whole herb is officinal, and is directed in our Pharmacopœia, under the name of lobelia. It should be gathered in August and September, when the fruit is most abundant. Sometimes it is kept simply dried, sometimes in powder, and not unfrequently comminuted and compressed in the form of small oblong cakes.

Properties. Lobelia is of a greenish colour in powder, of a feeble, somewhat irritating odour, and of a taste which is slight at first, but soon becomes acrid and nauseating, and spreads with a strong and peculiar acrimony through the fauces, not a little resembling that of tobacco. The herb imparts its virtues to water and alcohol. They are injuriously affected by a boiling heat. They probably reside chiefly, if not exclusively, in a peculiar organic alkaloid, called *lobelina*, which exists in the herb in combination with an acid. There is also a very small proportion of volatile oil, upon which its odour depends, but which probably possesses little medical efficiency.

Lobelina was first procured in a pure state by Professor Procter, of Philadelphia, who obtained it from the seeds by the following process. A tincture, prepared by treating the seeds with alcohol acidulated with acetic acid, is evaporated, and the resulting extract mixed with water and magnesia, by which the alkaloid is separated from its saline combination. The mixture is agitated with ether, which dissolves the lobelina, and yields it in an impure state by evaporation. It is purified by dissolving it in water, adding sulphuric acid in slight excess, boiling with animal charcoal, then separating it as before by magnesia, filtering, agitating the liquid with ether until wholly deprived of acrimony, and allowing the ethereal solution to evaporate.

Thus obtained, lobelina is a yellowish liquid, lighter than water, of a somewhat aromatic odour, and a very acrid and durable taste. It is soluble in water, but more so in alcohol and ether, the latter of which separates it from its aqueous solution. It has an alkaline reaction, and forms salts with the acids, most of which are soluble and crystallizable. With tannic acid, however, it forms an insoluble compound. At a boiling heat it is decomposed. A drop

of it given to a cat, rendered the animal prostrate and nearly motionless, with dilated pupils, for an hour; and the effects had not quite disappeared at the end of fifteen hours. It neither vomited nor purged.

Effects on the System. Lobelia is locally irritant, and, in its general influence, sedative to the nervous and circulating systems. In certain doses it operates as a nauseating emetic, and sometimes as a cathartic, and, in smaller doses, is expectorant and diaphoretic.

When chewed in small quantities it often produces, along with the peculiar acrimony in the mouth, fauces, and œsophagus, giddiness, headache, and general tremors, and at length, if continued, nausea and vomiting. In a larger dose, it acts promptly as an emetic, with distressing and continued nausea, copious sweating, feeble pulse, pale skin, and great general relaxation. Sometimes, as from digitalis, the pulse becomes intermittent. The Rev. Dr. Cutler states that it produced in himself a prickly sensation throughout the system, and a smarting sensation in micturition.

Poisonous Effects. Lobelia in over-doses, is capable of acting as a violent poison, and, being a favourite remedy with a certain class of uneducated empirics, has been in their hands the cause of numerous deaths, both in this country and Great Britain. At an inquest held in England, in November, 1853, on the occasion of a death from lobelia, Dr. Letheby, Professor of Chemistry in the London Hospital, stated that thirteen cases of poisoning had occurred from that drug, within the three or four preceding years, and that, in six of them, a coroner's jury had brought in a verdict of manslaughter. (*Lond. Med. Times and Gazette*, May, 1854, p. 491.) When lobelia vomits, it is, like tobacco, less apt to produce fatal effects; and, as this happens in most instances when large doses are taken, the ignorant practitioner, thinking that he has proved the innocence of the medicine by his experience with it, gives it freely and without hesitation in all cases. But in some individuals it fails to vomit, even in very large and repeated doses; and it is in these cases that death most commonly results. It is wonderful with what recklessness, according to published reports, the poison has been sometimes thrown in, dose after dose, in the cases of these insusceptible individuals, in the expectation that it would at length operate in the desired manner.

The effects of a poisonous dose of lobelia are usually a peculiar sensation of burning and acrimony in the fauces and œsophagus, intense epigastric distress with or without vomiting and purging,

general anxiety, a feeble pulse, faintness, muscular tremors and relaxation, profuse sweats, coldness of the surface, vertigo, and, finally, extreme prostration, delirium, stupor, sometimes convulsions, and death. From one poisonous dose, the fatal result may take place in five or six hours; but frequently the effect is produced by a succession of doses, repeated hour after hour, or day after day, so that it is impossible to determine the precise duration of the poisonous process. Nor is the quantity well determined, which will ordinarily prove fatal. In fact, the susceptibility to its effects is so variable, that no precise statement can be made on this point. Much, too, depends upon the occurrence or non-occurrence of vomiting. Dr. Letheby found in the stomach of a woman who had been poisoned with it, 110 grains; in the case of a man, a tablespoonful of the seeds; and in a child three years old, fifteen grains of the seeds in the bowels. He stated, in reference to the first instance just mentioned, that he had known much less than that quantity produce death, and thought that one-third of the amount found in the stomach would have been sufficient to kill the patient. (*Lond. Med. Times and Gazette, as above;* also *March*, 1853, p. 270.) It was the seeds that appear to have been given in these cases; and, as they are probably at least twice as strong as the herb generally, allowance must be made in estimating the poisonous dose of the latter. In most cases recorded, the quantities mentioned are quite indefinite, though often stated as large. From all that I have seen, I should infer that a drachm of the dried herb would be a dangerous dose, which ought not to be hazarded at once; though, if it should vomit, the patient might experience no serious inconvenience; and much larger quantities have, no doubt, often been given with impunity. Inflammation of the stomach and bowels has been noticed after death. But the probability is that the poison destroys life through its influence on the encephalic centres, especially that of respiration in the medulla oblongata; for, in animals poisoned with it, the heart continues to act after breathing has ceased. This fact was noticed in the experiments of Mr. Curtis and Dr. Pearson upon hedgehogs and cats. They state also that the lungs and the venous system generally were congested, as uniformly happens on death from asphyxia, and that the blood was fluid. (*Ibid.*, Aug. 1850, p. 285.) The treatment of poisoning by lobelia, is the same as in the case of tobacco.

Mode of Operating. The local irritant properties of lobelia, as of digitalis and tobacco, may give rise occasionally to a sympathetic

excitement of the circulation; but the direct effects of the medicine, after absorption, are undoubtedly, I think, sedative. From the experiments upon animals above mentioned, and from the intense nausea produced by the medicine, it might be inferred that its influence is prominently directed to the nervous centres which govern the functions of the respiratory organs and the stomach; and that the heart is secondarily involved; but more numerous and diversified observations are necessary to justify a positive conclusion upon these points. That the medicine is absorbed has not been absolutely proved; but may be fairly deduced from the strong analogy between its action and that of tobacco; and from the fact that, when injected into the rectum, it produces the same nausea, vomiting, profuse perspiration, and general relaxation as when taken by the stomach.

Therapeutic Application. Lobelia was used as a remedy by the aborigines, and was long empirically employed before it was adopted by the regular profession. It was first brought into general notice by the Rev. Dr. M. Cutler, of Massachusetts. In a communication published in Thatcher's Dispensatory, he speaks of its extraordinary efficacy in the relief of spasmodic asthma in his own case, in which he was induced to employ it by the representations of Dr. Drury, of Marblehead, in September, 1809. (Barton's *Veg. Mat. Med. of U. S.*, i. 191.) Since that time it has been much employed in the same and other spasmodic affections, though the use of it has been greatly abridged by the unfavourable results of its abuse, and the unfounded fears originating in this cause. When properly employed, lobelia is probably as safe as any other medicine acting powerfully on the nervous system; certainly quite as safe as tobacco, which it resembles in its effects, though considerably weaker.

It is chiefly with a view to the relaxation of spasm, that lobelia has been used as a sedative. Almost all writers unite in bearing testimony to its occasional extraordinary efficacy in the *paroxysm* of *spasmodic asthma*. It is, on the whole, the most efficacious remedy that I have myself employed in that affection. Given in the dose of half a fluidounce of the tincture, it generally produces nausea and vomiting, and not unfrequently affords prompt relief. I prefer, however, administering it in the smaller doses of one or two fluidrachms, repeated every half hour, hour, or two hours, until it excites nausea, and maintaining a moderate amount of this condition until the spasmodic symptoms are relieved. Should catarrhal inflammation, as not unfrequently happens, accompany

the spasmodic attack, it may be proper to precede its use by bleeding, and to employ the powder preferably to the tincture, in consequence of the alcohol contained in the latter. Like all other remedies, however, it sometimes fails in asthma; though I do not think I have ever used it without benefit.

Even in the *dyspnœa* connected with chronic organic disease of the lungs and heart, especially when it occurs paroxysmally, the remedy may be employed with advantage.

I use it habitually in *bronchial inflammation*, after due depletion, whenever I have reason to think that it is in any degree complicated with spasm of the bronchial tubes. It operates here not only as a nervous sedative, but also as an expectorant. It should, however, be associated with other expectorants, as tartar emetic, ipecacuanha, or squill.

In *pertussis* it has been recommended by the late Drs. W. P. C. Barton and Eberle, who employed it in several cases with unequivocal advantage. Dr. Eberle gave from fifteen to twenty drops of the tincture, with ten or twelve drops of syrup of squill, every two or three hours, to a child between one and two years old. He also found it, in combination with extract of belladonna, very efficacious in mitigating the disease. (*Treat. on Mat. Med. and Thérap.*, 4th ed., i. 88.)

It has also been recommended in *croup;* and, in the catarrhal variety of that affection, without false membrane, it will often prove very serviceable by relaxing the spasm. But it is probably in no degree superior to tartar emetic, and, from the uncertainty of its dose, and the danger of its abuse, is not advisable in that affection, unless as an adjuvant of other measures, when simple emesis has failed to produce relief. I have in this way used it with apparent advantage. To the pseudo-membranous variety it is inapplicable.

In *strangulated hernia*, it was employed with success by Dr. Eberle; half a pint of a strong decoction of the fresh herb having been given by enema, followed soon afterwards by half the quantity. Distressing nausea came on, with profuse perspiration, and universal relaxation, in which condition the hernia was reduced without difficulty. (Barton's *Veg. Mat. Med., ut supra*, p. 198.)

Lobelia is stated also to have proved useful in delivery, by relaxing rigidity of the os uteri, being given in small doses so repeated as to occasion slight nausea. (*Am. Journ. of Med. Sci.*, xvii. 248.)

It is a favourite remedy with the practitioners calling themselves

eclectics, who use it in most spasmodic diseases, besides those already mentioned, as in *epilepsy*, *chorea*, *hysteria*, *tetanus*, *cramps*, *and convulsions*. They also employ it externally as an anodyne in sprains, bruises, rheumatic and neuralgic pains, spasms, &c. In most of these complaints, it may no doubt be used with occasional benefit.

It is contraindicated by irritation or inflammation of the stomach and bowels.

Administration. The dose of the powder, as an emetic, is from ten to thirty grains; as a nervous sedative and nauseant simply, five grains, repeated every hour or two, the quantity being increased or diminished according to the effect produced, and the medicine suspended if vomiting or prostration ensue.

The *Tincture* (TINCTURA LOBELIÆ, *U. S.*) is made in the proportion of four ounces to two pints of diluted alcohol. Consequently, supposing the herb to be exhausted, a fluidounce would be equivalent to a drachm of the powder. The emetic dose of the tincture is about half a fluidounce; the nauseating and sedative dose, a fluidrachm.

An *Ethereal Tincture* (TINCTURA LOBELIÆ ÆTHEREA, *Lond.*, *Ed.*) is directed by the London and Edinburgh Colleges; being prepared with spirit of ether, instead of diluted alcohol. It is probably in no respect preferable to the simple tincture; while the ether renders it unnecessarily, and sometimes injuriously stimulating. Should lobelia and ether be simultaneously indicated, it would be better to use the simple tincture with Hoffmann's anodyne. The dose is the same as of the preceding preparation.

IV. ACONITE.

ACONITUM.

Origin and Properties. Though all the acrid species of Aconitum possess medicinal virtues, the *Aconitum Napellus*, common *monkshood*, or *wolfsbane*, is the only one now acknowledged by the U. States or British authorities. It is a perennial herb, from two to six or eight feet high, growing wild in the mountainous districts of central Europe, and cultivated both for medical and ornamental purposes. It is occasionally met with in our gardens, where it is valued for the beauty of its spike-like racemes of fine, purplish-

blue flowers. All parts of the plant are acrid; but the leaves and root only are officinal.

ACONITE LEAVES.—*Aconiti Folia.* U.S., Lond.—*Aconitum.* Ed.—Aconite leaves are three or four inches in diameter, divided, almost down to the base, into from three to seven wedge-shaped segments, each of which has two or three lobes; the several lobes being cut, at their edges, into linear pointed teeth. They are somewhat rigid, of a deep green above, and light green beneath, and rather smooth and shining on both sides. When fresh, they have a feeble narcotic odour, most perceptible when they are bruised, and a taste at first bitterish, but becoming hot and acrid, with a remarkable sensation of tingling and numbness, which extends through the whole mouth and fauces, and sometimes lasts for hours. They inflame the mouth if long chewed. When dried, they retain their acrimony, though it is later developed in the mouth. Their virtues are impaired by long keeping.

ACONITE ROOT.—*Aconiti Radix.* U.S., Lond.—*Aconitum.* Dub.—Aconite root is spindle-shaped, about as thick as a finger at the base, tapering to a point, three or four inches or more long, brownish externally, internally whitish and fleshy, with many long fleshy fibres or rootlets. Not unfrequently two roots are joined laterally at the base, one deep-brown, and the other lighter coloured and younger. The taste is at first sweetish, afterwards acrid like that of the leaves, but stronger. The root shrinks in drying, but retains its acrimony, the degree of which may be considered as the measure of efficiency, as regards both the root and leaves.

Active Principle of Aconite. The virtues of aconite reside chiefly if not exclusively in a peculiar organic alkaloid, which has been variously denominated *aconitin*, *aconitina*, and *aconitia*. I prefer the last name. As this principle is isolated for medical use, it will be particularly described among the preparations. The plant contains also, but in very small proportion, a volatile principle, to which some have been disposed to ascribe, though erroneously, its acrid properties. It is probably the source of the slight odour of the leaves.

1. *Effects upon the System.*

Two elaborate monographs have been published on the subject of aconite, one by Dr. Alexander Fleming, of Cork, in the year 1845; and the other more recently by Professor Schroff, of Vienna, to the former of which I am especially indebted for many of the

facts stated in the following account of the action of the medicine. Some valuable observations were also made by the late Dr. Pereira on its physiological action.

In general terms, aconite may be said to be locally irritant, and, in its general operation, directly sedative to the nervous system and the circulation, while it occasionally acts as a diaphoretic or diuretic.

Applied to the skin, it first occasions a feeling of heat, which is soon followed by prickling or tingling sensations, with numbness. In the mouth it gives rise more speedily and strongly to the same sensations, which are extended also to the fauces. When applied to the eye, it is said by most observers to cause contraction of the pupil; but Professor Schroff states that it produces the opposite effect of dilatation, when used in sufficient quantity. Both observations are probably correct; contraction being the result of its immediate operation, while the dilatation occurs when it has been employed so largely, or so long, as to exert its benumbing influence on the nerves which govern the movements of the iris.

Given internally in medicinal doses, so as to bring the system moderately under its influence, it causes a feeling of warmth in the epigastrium, and a general glow, which may be ascribed to its first excitant action upon the mucous membrane of the throat and stomach, extended by sympathy over the body. A brief acceleration of the pulse, which sometimes takes place, may be referred to the same cause. Nausea is often also produced, but seldom vomiting from the doses mentioned. After a short time, the same mingled feelings of prickling, tingling, and numbness, which it causes in the surface of application, are experienced at the ends of the fingers, in the lips, and perhaps elsewhere, together with a sense of muscular weakness; while the pulse is reduced in frequency and force, and the number of respirations correspondingly diminished. According to Störck the perspiration and urine are also increased; and Schroff states that, in sufficient quantity, it causes an extraordinary augmentation of the latter secretion (*Ed. Month. Journ.*, Oct. 1854, p. 370); but these effects are certainly not constant, as they have escaped the attention of many observers.

In larger doses, but still within medicinal limits, aconite produces much nausea and occasionally vomiting; the sensation of tingling and numbness is extended more or less over the whole body; headache, giddiness, dimness of vision, and mental confusion are sometimes experienced, especially if any exertion is made; the

pulse is reduced occasionally as much as 15 or 16 strokes in the minute, and the respiration accordingly; and a general condition of debility is induced, which may continue for hours or even days.

The phenomena above referred to generally begin to appear in twenty or thirty minutes, are at their height in an hour or two, and continue with little abatement for three, four, or five hours; and, if the dose be repeated before the influence of the first has subsided, so as to produce a cumulative effect, the symptoms will continue for twelve hours, a day, or even two or three days, according to the greater or less length of time during which the medicine has been administered. Not unfrequently, after the direct sedative operation has ceased, a degree of reaction takes place, according to a well-known law of the system; and the circulation, respiration, and general temperature are somewhat increased.

A remarkable quality in the operation of aconite is that, while it diminishes both general and special sensibility, consciousness is usually in no degree impaired. Thus, Dr. Pereira observed that a dog, under the influence of a full dose, would wag his tail when noticed by his master, and endeavour to follow him around the room, though quite insensible to pinching, the pricking of a needle, &c. Yet, along with this insensibility to impressions upon the surface, it is said that neuralgic pains about the joints are sometimes felt, when large quantities have been taken.

As in the instance of digitalis, it is said that, when under the influence of aconite, the pulse is increased considerably in rapidity upon rising from the recumbent to the sitting or standing posture, showing its debilitating influence; for a weakened pulse is almost always more increased in frequency by exertion than a healthy one. The effect of change of position, or other muscular effort, is sometimes so great, when the system is under the full effect of aconite, as to induce a feeling of faintness, and even an approach to syncope; so that, in the use of the medicine, when the patient is found to be decidedly affected by it, care should be taken to guard against undue movement, lest serious prostration might occur.

Allusion has been made to the effect of aconite on the pupil when locally used. There is the same contradiction of statement as to its effects when internally administered; some stating that it contracts, others that it dilates the pupil. The probability is that the contraction is the general rule; but that, when the depressing effect is very great, the iris may become paralyzed with other parts, and dilatation consequently take place.

Poisonous Effects. Aconite is a powerful poison, and has often caused death when too largely taken. The symptoms are simply an exaggeration of those already described. The characteristic sensation in the mouth and fauces is very strong; the patient complains of intense burning in his œsophagus and stomach, with much thirst; severe and distressing nausea comes on, attended generally with violent and protracted vomiting, and sometimes with purging; and spasmodic pains are often experienced in the stomach and bowels. These are the results of the direct action of the poison upon the alimentary canal. At the same time, symptoms of the most severe nervous disturbance make their appearance, as headache, sometimes violent; giddiness; dimness of vision, with contracted or expanded pupil; constriction of the throat; prickling and tingling, with numbness, over the whole system; general diminution of sensibility; tremors; loss of command over the muscles; inability to speak distinctly; sometimes lancinating pains in the joints, and a general condition of nervous prostration. The circulation and respiration are also greatly depressed, the pulse being at first reduced to 50, 40, or even 36 in the minute, and afterwards, as the weakness increases, becoming more frequent again, but small, irregular, and extremely feeble. Consciousness is retained till near the close; but at last, in fatal cases, slight delirium comes on, followed by stupor, and sometimes spasmodic movements resembling convulsions; general paralysis of voluntary motion and sensation ensues; the patient becomes blind, deaf, and speechless; the pulse is no longer perceptible; the extremities are cold, and the body is often bathed in sweat; the face is pallid and shrunken, and the eyes glassy; and the universal prostration ends in death, sometimes in little more than an hour, sometimes as late as eight hours from the taking of the poison, but generally in about three or four hours. All these symptoms are not present in every case; but there is not one which does not sometimes occur. Convulsions are not common; and the movements which do occasionally take place are scarcely entitled to the name. Not unfrequently the muscles are perfectly quiescent to the last. As in poisoning with other narcotics, the dose necessary to destroy life varies exceedingly in different individuals, but is greater, as a general rule, when free vomiting has been early produced by the medicine. Five grains of the fresh extract, one drachm of the root, and eighty drops of the strong tincture of the root, are said severally to have caused death; though larger quantities have often been taken without the same result.

On *dissection*, inflammation of the stomach and bowels is said to have been noticed, with general venous congestion, and the blood in a coagulated or coagulable state. According to some observers, the heart of animals poisoned with aconite has been found perfectly quiescent immediately after apparent death; others have found it contracting; and the probability is that sometimes one of these conditions exists, and sometimes the other.

The *treatment* consists in washing out the stomach thoroughly with diluent drinks if vomiting has already taken place, and, if not, by means of an emetic dose of ipecacuanha, with similar dilution; and afterwards administering opiates to allay irritation, and carbonate of ammonia and alcoholic stimulants to support the strength. Generally speaking, the opiate would be best given by enema. Stimulation externally, also, by a sinapism to the epigastrium, and heated rubefacients to the extremities, is called for. Should respiration have ceased, it ought to be restored artificially, in the hope that the heart may not have completely ceased to act, or at least not entirely lost its susceptibility; and, if apparent death from syncope has occurred, efforts should still be made to rouse the heart into action by means of an electro-magnetic machine. If the medicine has been taken a considerable time previously to the commencement of treatment, so that a portion of it may have entered the bowels, a dose of castor oil or other quick non-irritating cathartic should be given, in addition to the other measures. Iodine has recently been recommended as an antidote. It may be given in the form of the officinal compound solution. It is sometimes astonishing to see how rapidly, under the influence of opiates and stimulants, the patient passes from a state of the most profound prostration, and greatest danger, into complete safety; showing that the action of the poison is mainly functional, and that, whatever active congestion or inflammation may be induced by it, is comparatively trivial.

2. *Mode of Operating.*

Though locally irritant to the vascular tissue, the primary effect on the nervous extremities themselves seems to be sedative; for a feeling of numbness attends the prickling sensation; and the effect altogether is that often felt in cases of commencing or partial paralysis. The feeling of warmth is probably the result of the vascular excitement. I have already expressed my belief, that the general but evanescent phenomena of excitement, some-

times produced, are the result of a sympathetic extension of the local excitant impression. The first direct effects upon the system are probably produced through absorption; for they are the same whether the medicine is taken into the stomach, or applied to the rectum, the areolar tissue, one of the serous membranes, the abraded skin, or a wounded surface. These effects are directly sedative to the nervous system, and apparently so to the circulation and respiration. The probability, however, is that it affects these functions, not by acting immediately upon the heart and lungs, but by first depressing the nervous centres which control the movements of these organs. The circumstance that the heart is sometimes found active, and sometimes quiescent after the suspension of respiration, shows that the influence of the poison is occasionally predominant in the nervous centre of respiration, and occasionally in that which regulates the heart. The increased frequency, weakness, and irregularity of the pulse which follows the first depression, in cases of excessive action from the medicine, may be ascribed to the complete paralysis of the nervous centre in the medulla oblongata, so that the heart is now left to the operation of the blood upon its own inherent susceptibility, and acts therefore hastily and irregularly, because not duly supported from the great centre of influence. So long as this centre remains unparalyzed, the operation of the medicine, through it, is to diminish the frequency of the pulsations.

3. *Therapeutic Application.*

Aconite was known to the ancients as a poison; but they do not seem to have been aware of its medicinal powers. In reference to these, it was first brought into notice by Baron Störck, of Vienna, in 1762. The general indication which it is suited, through its sedative properties, to fulfil, is to reduce morbid excitement of the nervous and circulatory systems. Hence it may be inferred to be useful as an anodyne, antispasmodic, and antiphlogistic remedy. In the two former capacities, however, it should be employed only when the pain and spasm to be relieved are dependent on nervous irritation. To these conditions, when the result, as often happens, of a depressed state of the nervous centres, the remedy is wholly inapplicable; differing in this respect from the nervous stimulants, which often operate favourably in both conditions. Aconite is also contraindicated in gastric and intestinal inflammation, in consequence of its local irritant property, and in cases of great general debility,

even when alternated with morbid excitement, from its powerfully depressing effects.

Inflammations. The sedative powers of aconite naturally suggested its use in inflammations; and, so far as mere reduction of the heart's action and of nervous force can prove curative in these diseases, benefit may be expected from the medicine. It was recommended by Dr. Fleming especially in *inflammation of the brain.* It has also been employed in *angina*, *bronchitis*, *pneumonia*, various *cutaneous eruptions*, and the *inflammatory conditions of scrofula and phthisis.*

But the disease in which it has enjoyed most reputation as an antiphlogistic is *inflammatory rheumatism.* As a nervous element of excitement enters largely into the constitution of this disease, aconite would seem to be peculiarly appropriate. Recommended originally in acute rheumatism by Störck, it has been much used in Germany and other parts of continental Europe, and has at a comparatively recent date enjoyed some credit in Great Britain and this country. By M. Lombard, of Geneva, Switzerland, it has been strongly recommended as having a specific influence over the disease. Of 21 cases of acute rheumatism reported by Dr. Fleming, in which aconite was used, all were cured; the shortest duration of treatment being 2 days, the longest 17 days, and the average between 5 and 6. Upon the same authority, the improvement is often very speedy; "some alleviation of the pain being occasionally experienced in the course of an hour after the first dose has been taken; whilst there are few cases in which decided relief, with abatement of the redness, tension, and tenderness, is not obtained in a few hours. A longer period seems to be required to disperse the inflammation in the smaller joints than in the larger ones." A peculiar advantage of the treatment, judging from the results in the cases alluded to, is the infrequency of the supervention of cardiac affection; two only of the cases having offered this complication. The convalescence too was extremely short; and there was less stiffness in the joints than is ordinarily left in this affection. This is great success, and, had the remedy proved equally efficacious in other hands, would authorize its universal adoption. But this has not been the general experience. Still, I have no doubt that aconite, like most of the articles of this class of medicines, has considerable efficacy in acute rheumatism; and it may be appropriately employed as an adjuvant of the lancet, or as a substitute for it when circumstances forbid its use.

In *chronic rheumatism* it has also been recommended, but, though I have frequently employed it in that affection, I do not remember to have effected a cure with it in one case; and the chief benefit which has accrued, has been from the relief of pain through its local application to the affected part. It is more especially applicable to those cases in which the disease approaches the neuralgic or nervous form.

As regards the employment of this remedy in the phlegmasiæ generally, it labours like all the other nervous sedatives under the capital defect, that it does not lessen the quantity or alter the quality of the blood, which are indications of cure quite as prominent as to lessen the force with which it is distributed. It cannot, therefore, be relied on as a substitute for the lancet, or the arterial sedatives, particularly the antimonials.

Vascular Irritation or Active Congestion. The condition of this kind to which aconite would appear to be best adapted, is active congestion of the brain. Its sedative influence at once on the nervous centres, and the circulation, is what is specially wanted here. But, as it does not lessen the quantity of the blood, it cannot be depended on in plethoric cases, in which there is no substitute for the lancet, or other depletory measures. As an adjuvant, however, of these measures, it may be resorted to, and also as a substitute when the patient is not in a state to admit of depletion. In those determinations of blood to the head which occasionally take place from the direction thither of gouty or rheumatic irritation, and in other instances associated with an irritable condition of the nervous system, aconite is a very appropriate remedy. If, at the same time, there should be an excessive action of the heart, as in hypertrophy of that organ, the indication for its use would be still stronger. *Inflammation of the brain*, *apoplexy*, and *convulsions* may probably be averted in some instances by a timely and appropriate use of aconite; and *headache and vertigo* may often be relieved. But care must be taken not to confound these affections arising from vascular fulness of the brain, with similar affections from an anemic condition, in which aconite is contraindicated.

Active hemorrhage also offers an indication for the use of this remedy, which may be employed to reduce the frequency and force of the heart's action, when bleeding may be inappropriate, or may have been employed without sufficiently relieving the arterial excitement.

Fevers. In the *idiopathic fevers*, though perhaps occasionally use-

ful, aconite is much inferior to the refrigerant and depletory remedies usually employed, and is often objectionable from its tendency to irritate the stomach, already more or less irritated in these affections, and almost always more than ordinarily irritable. It has been employed with asserted success in intermittent fever; but this is a credit which it shares with so many other medicines, that it is of little value. It is not pretended that it can be compared with cinchona in efficiency.

Organic Diseases of the Heart. The remarks made upon the use of digitalis in these affections are so exactly applicable to aconite, that it would be useless to repeat them here. (See *page* 120.) It is sufficient to say that this remedy may sometimes be advantageously resorted to, when digitalis disagrees with the patient, or in order, by varying the remedies employed, to prevent a too rapid impairment of the susceptibilities, and thus to prolong the period during which remedial or alleviating measures may be employed with effect.

Nervous Irritation. It is in the different forms of this pathological condition that aconite is most useful, and of these forms, *neuralgia* is that in which it has proved pre-eminently so. It is, indeed, one of the standard remedies in nervous pain. There is no variety of this affection in which it may not be employed, with the reasonable hope of permanent or temporary benefit. But *neuralgic rheumatism*, and *gout* are the special affections in which it has proved most serviceable, and in which it is probably most employed. In all the varieties of neuralgia, the medicine may be used both internally and externally; or it may be applied to the seat of the disease, while some other remedy or remedies may be addressed to the system. In the local use of it, the application is generally made by friction, which should be continued until decided sensations of tingling and numbness are induced, or until the neuralgic pain itself ceases.

The remedy has been found useful by some practitioners in the *pains of secondary syphilis*, in which it may be used in connexion with the alteratives destined to eradicate the disease. It has also been employed for the relief of pain in *carcinoma*.

Palpitation, of gouty or rheumatic origin, may also be advantageously treated with aconite, which, in this affection, as in neuralgia, may be employed both generally and locally.

In *pertussis* and *epilepsy*, the remedy has also been used, and may sometimes prove serviceable; but it cannot be relied on for the cure.

It is asserted to have been used beneficially in *paralysis* and in *amaurosis*. At the first glance, it might seem to be contraindicated in these affections; as both not unfrequently result from its poisonous action. But a little consideration will show that, without giving any countenance to the homœopathic doctrine of "*similia similibus curantur*," we may sometimes employ aconite in paralytic diseases, in full accordance with sound therapeutic principles. Palsy generally results from a loss of function in the nervous centres. This loss of function may depend on a direct depression of the centre, as under the poisonous influence of aconite, or from an over-excitement, vascular irritation, or active congestion of the centre, as in inflammation or active congestion of the brain or spinal marrow. Now, while it is obvious that aconite would probably only aggravate palsy originating in the first of these causes; it is no less clear that, in the cases dependent on over-excitement, it is one of the very remedies which would be suggested by the views of its powers here taken. It would prove serviceable by acting as a sedative to the morbidly excited nervous centre. I have had no experience with aconite in palsy; but in certain cases of the disease, originating in or sustained by active congestion of the brain or spinal marrow, without positive structural lesion, I should have no hesitation in employing it, should circumstances prevent the use of other habitual remedies, as bleeding, purging, the antimonials, &c.

It is recommended by Cazenave in certain *irritable cutaneous eruptions*, in which it may act beneficially not only by diminishing the capillary circulation in the surface, but also by moderating an abnormal sensitiveness of the cutaneous nerves.

Finally, aconite has been found useful by M. Fouquier in *passive dropsies*, in which it proves serviceable by its diuretic property; has been recommended in *amenorrhœa*, connected with chronic congestion, or an habitual spasmodic condition of the uterus; and has been employed, with supposed benefit, in metastatic abscess or purulent infection; though upon what principle it would be likely to operate beneficially in that affection, I should be at a loss to determine.

4. *Administration.*

The effects of aconite may be obtained from the powder, extract, tincture, or isolated active principle: and all these forms are officinal.

The *powdered leaves* may be given in the dose of one or two grains; but the medicine is seldom used in this form.

Two *extracts* are officinal; one, the *inspissated juice of the fresh leaves* (EXTRACTUM ACONITI, *U. S.*, *Lond.*, *Ed.*), which, however, is very uncertain, and sometimes very feeble if not inert; the other, the *alcoholic extract* (EXTRACTUM ACONITI ACOHOLICUM, *U.S.*), which is made by evaporating a tincture of the dried leaves, and, if made from recently dried leaves, may be efficient. The dose of the former is one or two grains; of the latter half a grain or a grain. An alcoholic extract might also be prepared from the root, of which the dose should not exceed one quarter of a grain to begin with.

The tinctures are much more employed than the powder or extract. The U. S. Pharmacopœia recognizes two tinctures, having retained the old tincture of the leaves, and adopted a new and strong one of the root. It is of the utmost importance that these tinctures should not be confounded in prescription; as the most serious consequences might ensue from a mistake.

Tincture of Aconite Leaves (TINCTURA ACONITI FOLIORUM, *U.S.*) is a weak preparation, having all the uncertainty of the dried leaves, and should be discarded from the Pharmacopœia. The dose is from twenty to thirty drops.

Tincture of Aconite Root (TINCTURA ACONITI RADICIS, *U.S.*, *Dub.*: TINCTURA ACONITI, *Lond.*) is a very strong tincture of the root, made, according to the directions of our Pharmacopœia, in the proportion of a pound to a pint of alcohol. It has about the strength of the British tinctures, and is nearly or quite saturated. It has the great advantage, over the preceding preparation, of comparative uniformity and certainty of operation; *but it is of great importance to bear in mind its poisonous operation in over-doses, and to be extremely careful, in prescribing it, not to mistake it for the tincture of the leaves.* It is, on the whole, the most efficient and convenient preparation of aconite, whether for internal or external use; and there need be no danger with due caution. It has, indeed, almost superseded the other forms. The commencing dose should not exceed five drops in any ordinary case, which may be repeated three times a day, and increased gradually with each dose, after the first day, until some sign of its action is afforded, such as tingling and numbness in the fingers or lips, diminished frequency of the pulse, or headache with giddiness. After the dose in which it is capable of acting is ascertained, it must be increased, if at all, with great caution, and, should unpleasant symptoms occur, must be at once suspended.

When externally used, it may be most conveniently applied by friction with a small piece of sponge, tied to the end of a stick, and

saturated with the tincture. The rule is to persevere with the friction until the peculiar sensation of prickling or numbness in the part is produced, or till the object for which it is employed is accomplished. Care should be taken not to apply it to abraded, ulcerated, or wounded surfaces, or to that of a mucous membrane.

Whatever preparation of aconite is used, the dose may be repeated, as in the case of the tincture of the root, three times a day, and gradually increased until it acts.

ACONITIA. *U. S.—Aconitin.—Aconitina.*

This may be prepared in the following manner. To an alcoholic extract of the root add water acidulated with sulphuric acid, by which the native salt of aconitia is decomposed, and a readily soluble sulphate is produced. Filter the liquid, and add solution of ammonia, which separates and precipitates the alkaloid with impurities. From the precipitate extract the aconitia by means of ether, and allow the ethereal solution to evaporate. For details of the procedure, the reader is referred to the U. S. Dispensatory.

When quite pure, aconitia is white; but, as in the shops, it is often slightly coloured. Obtained by the slow evaporation of its alcoholic or ethereal solution, it is transparent like glass. The alkaloid is uncrystallizable. It is inodorous, of a bitter taste, and has the same singular acrimony as the herb or root. It is unalterable in the air, fusible, at a high temperature decomposed, sparingly soluble in water, readily soluble in alcohol and ether, and capable of neutralizing the acids, with which it forms uncrystallizable salts. It consists of nitrogen, carbon, hydrogen, and oxygen.

Aconitia acts on the system in the same manner as the tincture, but with greater energy. One-fiftieth of a grain killed a sparrow; and the same quantity is said to have proved dangerous and nearly fatal, in the case of an old woman. In an instance recorded by Dr. Golding Bird, two and a half grains produced poisonous symptoms; but the patient vomited and was saved. When rubbed on the skin in the form of an ointment, or in alcoholic solution, it occasions violent heat, tingling, and numbness, which may continue from two or three to eighteen hours. "A minute portion of an ointment, composed of a grain of the alkaloid to two drachms of lard, applied to the eye, causes almost insupportable heat and tingling, and contraction of the pupil." (Pereira, *Mat. Med.*, 3d ed., p. 2176.) There would seem to be no occasion for aconitia as a distinct preparation; for the tincture of the root is capable of producing all the desired effects both internal and external. At all

events, the use of the alkaloid should be confined to external application. It may be employed in alcoholic solution or ointment; in the former case, one grain being dissolved in a fluidrachm of alcohol; in the latter, two grains being rubbed, first with six drops of alcohol, and then with a drachm of lard. The proportion of the alkaloid, if found necessary upon trial, may be doubled or quadrupled. The preparations are to be applied by friction. The same rule is necessary in relation to the continuance of the friction, and the same caution in reference to the surface of application, as in the employment of the tincture of the root.

V. AMERICAN HELLEBORE.

VERATRUM VIRIDE. *U.S.*

Under this name, the U.S. Pharmacopœia recognizes the root or rhizome of *Veratrum viride*, variously called *American hellebore*, *swamp hellebore*, *Indian poke*, &c., an indigenous perennial, growing abundantly in wet, low, or swampy places, in most parts of our country from Maine to Georgia. The root should be collected in the autumn after the fall of the leaf, and, as it is injured by time, should not be kept longer than a year.

Properties. The body of the root or rhizome is fleshy, somewhat more than an inch long by an inch in thickness, coated with membranous coverings above, and thickly invested beneath with numerous whitish or yellowish fibres or rootlets. In the recent state, it has a disagreeable odour, which is lost by drying. Its taste is bitter, with an unpleasant acrimony, spreading through the mouth and fauces, and very durable. It imparts its sensible properties to water and alcohol; but its virtues are impaired by heat, and appear to be destroyed by long boiling; as Dr. Osgood found an extract prepared from the decoction nearly inert. It may be inferred from the botanical relations of the plant, and from the similarity of its effects with those of Veratrum album, that it owes its activity, at least in part, to the alkaloid denominated *veratria;* but the fact has not been positively demonstrated.

Effects on the System. American hellebore bears so close a resemblance in its effects to the medicines belonging to this class already described, that it could not with propriety be separated from them in any system of arrangement. Like them it is locally irritant, in its general action sedative to the nervous system and

circulation, and more or less stimulant to the secretions. For a knowledge of its physiological effects, we are mainly indebted to Dr. Charles Osgood, of Providence, Rhode Island, who appears to have had his attention directed to the subject by Professor Tully, of Yale College, by whom the medicine had long been habitually employed, and recommended in his lectures. The results of his investigations were made known in a communication published in the *American Journal of the Medical Sciences* for August, 1835 (xvi. 296). His statements have since been amply confirmed by others, and especially by Dr. W. C. Norwood, of Cokesbury, S. C., who deserves the credit of having aroused the attention of the profession to the subject, and of having thus given much greater extension to the use of the medicine than it had ever before received.

Locally applied, American hellebore is capable of producing irritation, rubefaction, and even vesication of the surface. Snuffed into the nostrils in the form of powder, even much diluted, it acts as an errhine and sternutatory. Its acrid impression on the mouth and fauces, when chewed, has been already mentioned. When swallowed, it is apt to cause uneasiness in the epigastrium, which, when the dose is sufficiently large, is followed by nausea and vomiting, the latter effect being often protracted, and attended with much retching, and sometimes with hiccough. Dr. Osgood noticed, in his own case, that the vomiting was effected by a spasmodic contraction of the stomach itself, without participation of the diaphragm and abdominal muscles; and, in another individual, was preceded by a sensation as of a ball rising in the œsophagus, the result no doubt of a spasmodic contraction of that tube. The antecedent and attendant nausea does not seem to be severe, though the prostrating effects on the system, as will be more particularly noticed directly, are often very striking. The emesis is usually later in occurring from this than from other emetic medicines; three-quarters of an hour or more, not unfrequently elapsing, after its exhibition, before this effect is experienced. A fact which, considering the drastic properties ascribed to *veratrum album*, was not anticipated, but which appears to have been confirmed by almost all who have reported their experience upon the action of the medicine, is that *it seldom if ever purges.* The remarks hitherto made have reference to its local operation. Its effects on the system are even more striking.

From doses insufficient to vomit, along with the epigastric uneasiness, or independent of it, there are sometimes feelings of chilli-

ness, and considerable diminution in the frequency and the force of the pulse, with a sense of weakness in certain muscles, or want of due command of them, which are probably the results of a direct sedative influence upon the nervous centres. As a proof that it is not from the depressing influence of nausea that the reduction of the pulse takes place, Dr. Norwood states that he has reduced it as low as thirty-five in the minute, without the least nausea and vomiting. (*Charlest. Med. Journ. and Rev.*, Nov. 1852, p. 768.) He also speaks of a feeling of numbness and tingling, which he had experienced about the joints previously to vomiting, as well as during and after that process. (*Ibid.*, p. 770.) We are told by Dr. Osgood that the farmers in New England, in order to protect their crops from birds, were in the habit of scattering in their fields grains of corn, which had been soaked in an infusion of the root of the American hellebore. Soon after eating this grain, the birds became incapable of running or flying, so that they were readily caught; but, if left undisturbed for a time, they recovered from the paralyzing effect, and flew away. It is seen, then, that a reduction of the circulation, and a partial paralysis of sensation and motion, are produced by the medicine independently of nausea; and it is a very probable inference, that the higher degrees of these sedative effects, though associated with nausea and vomiting, and possibly increased by them, are still mainly dependent on the same depressing power over the organic, and, to a certain extent, the animal nervous centres.

When the medicine is carried so far as to produce nausea and vomiting, its depressing effects on the circulation and nervous system are often very striking. The pulse falls from 75 or 80 down to 35 or 40, and at the same time becomes small and feeble, and occasionally almost imperceptible. The surface is pale and covered with a cool sweat; the patient at the same time experiencing a sense of chilliness, and sometimes of tingling or numbness. Headache, vertigo, dimness of vision with dilated pupils, faintness, a feeling as of stiffness of certain muscles, and a want of command over them, are other symptoms evincive of the sedative operation of the medicine. These signs of prostration are sometimes so great as to become alarming; although I have seen no account of fatal poisoning.

All agree in the statement, that the general depressing effects on the nervous system and circulation are attended with stimulation of the secretory functions. The salivary, pulmonary, biliary, and urinary secretions are increased, it is asserted, by doses insufficient

to occasion nausea and vomiting; and, during the existence of this condition, the same effect is produced upon the function of the skin.

An excessive action of the medicine is easily controlled by opiates and alcoholic stimulants. In cases of extreme nausea and vomiting, the opiate should be administered by enema.

Therapeutic Application. The indications which American hellebore seems to be capable of fulfilling, are to reduce the circulation when morbidly excited, and to calm nervous irritation. It has been used chiefly in inflammations, fevers, and nervous diseases.

1. In *inflammations* the medicine acts only as a sedative, and not probably by changing the character of the blood. It should not, therefore, be used to the exclusion of the lancet, and other measures calculated to meet the latter indication. But, when the state of the system does not admit of depletion, it may sometimes, I have no doubt, be employed with advantage. This remark applies to the phlegmasiæ generally, excluding gastric inflammation. But it is in the treatment of pneumonia and rheumatism that the medicine has acquired most credit.

As a remedy in *pneumonia*, it was recommended by Dr. Osgood; but did not come into extensive use until after Dr. Norwood's publication. Since then, it has been much employed, especially in the South, where pneumonia often assumes a form which does not well bear depletion; and the testimony in its favour is so strong, and from so many sources, that it is impossible to refuse it credence. The plan recommended by Dr. Norwood is to commence with eight drops of the saturated tincture, which is to be repeated every three hours, with the addition of a drop to each successive dose, until the pulse is reduced sufficiently, or nausea and vomiting supervene; and afterwards the dose is to be so managed, in respect to amount and interval, as to sustain the depressed state of the circulation with as little disturbance of stomach as possible. When the medicine is more than usually disposed to nauseate, the effect may be counteracted by a little morphia. It is asserted that the symptoms of inflammation decline with the reduction of the pulse, and the patient in due time enters into a very favourable convalescence.

In *acute rheumatism* the remedy would seem to be no less efficacious; being, as in the former case, employed with a due regard to the necessity for depletory measures. In this disease it may often be advantageously associated with opiates, which afford ease to the patient, while the sedative remedy reduces the excitement. It should be given every three or four hours, in such doses as not to

occasion vomiting, and gradually increased as the stomach is found to tolerate it. Dr. Osgood states that he knows of no medicine, except perhaps cimicifuga, to which the disease more easily yields.

It has also been recommended in *chronic rheumatism*, but is not considered so efficacious as in the acute, and must be used several days before benefit can be expected. I should suppose it, from its physiological properties, to be peculiarly adapted to the *neuralgic form* of rheumatism.

In *gout* it has been equally praised; and Dr. Tully thinks that, with proper management, it will effect cures in a majority of cases. He considers it better adapted to that affection, in feeble constitutions, than colchicum, because less apt to weaken by exhausting operations on the bowels.

Dr. Tully recommends it also in *dysentery* when not malignant.

In a case of *puerperal peritonitis*, it was employed with favourable results by Dr. J. R. Murphy, of Chesterfield, Illinois. (*St. Louis Med. and Surg. Journ.*, xiii. 255.)

2. Of the *idiopathic fevers*, the one in which the medicine has been employed with the greatest supposed success, and in which it has been strongly recommended by Dr. Norwood, is *enteric or typhoid fever*. Having never used it in this complaint, I may not perhaps be considered as entitled to the expression of an opinion as to its efficacy or appropriateness; but, being much in the habit of seeing and treating typhoid fever, and often in its worst forms, and finding it to yield to agents much less powerfully depressing than the one in question, and much less likely to provoke an irritation of stomach which is especially to be avoided, I cannot but entertain great doubts, at least of its necessity, in that affection.

3. Of the *nervous diseases*, *neuralgia* in its various forms, but especially when occurring in rheumatic and gouty patients, may be treated by this remedy both internally and externally. I should, however, expect less from it, than from the cerebral stimulants. In severe or frequently recurring *palpitations* of the heart, it would be an appropriate remedy. It is said also to have proved useful in *spasmodic asthma*.

In reference to its influence over the secretions, except as an incidental effect, it has been comparatively little employed; but it seems to have proved useful as a *cholagogue*, in deficient hepatic secretion, with dyspeptic sensations and mental depression. It might be tried in *jaundice* when the ordinary measures fail.

Administration. American hellebore may be given in substance,

tincture, or extract. The dose of the powder is one or two grains, to be repeated every three hours, and increased if necessary. From four to six grains, according to Dr. Osgood, will generally vomit.

The *extract* should be made by inspissating the expressed juice of the root at a low temperature. The dose of it is from one-quarter to one-half of a grain, repeated as above.

The *tincture*, however, is the preferable preparation; as it will keep unchanged for a long time. In order to insure uniformity of strength, as far as possible, it should be saturated. Dr. Osgood prepared the tincture with six ounces of the fresh root to a pint of diluted alcohol. Dr. Norwood's tincture is made with eight ounces of the dried root and a pint of officinal alcohol; maceration being continued for two weeks. I prefer the latter, as alcohol is probably a better solvent than diluted alcohol; and, by the use of the larger proportion of the root, the menstruum is more likely to be saturated. The proportion is larger relatively to Dr. Osgood's tincture than it seems to be, because the dried root is employed instead of the recent. But care should be taken that the root has not become deteriorated by long keeping. The dose of Dr. Norwood's tincture, which should always be prescribed, is six or eight drops, to be repeated every three or four hours, and increased if necessary.

In exhibiting any one of the preparations, the increase of the doses successively is to be continued until some obvious effect is produced. The occurrence of nausea and vomiting, or a sufficient reduction of the pulse without these symptoms, should be the signal for refraining from any further increase; and, should the former effects continue, the medicine should be suspended, and, if resumed, should be given in smaller doses.

An *ointment* was formerly officinal, but has been discarded from the U. S. Pharmacopœia as superfluous.

Should the effects of the local application of the remedy be desired, they may be most conveniently obtained by the use of the saturated tincture. It may be applied by friction in neuralgic and rheumatic cases.

VI. VERATRIA. *U. S., Lond., Ed.*

Veratria is an organic alkali, found in white hellebore and cevadilla, in which it is said to exist in combination with gallic acid. As already stated, it probably exists also in the American hellebore. Before treating of the alkaloid specially, it will be proper to give a brief notice of the substances of which it constitutes a characteristic ingredient, especially as they have a place in the officinal catalogues.

1. WHITE HELLEBORE.—VERATRUM ALBUM. *U. S.*

Origin and Properties. This is the officinal title for the root or rhizome of *Veratrum album*, an herbaceous perennial plant, growing wild in the mountainous districts of Continental Europe, and abundant in the Alps and Pyrenees. As found in our shops, it is cylindrical, or in the shape of a truncated cone, from one to three inches long and an inch or less in thickness, externally blackish, wrinkled, and rough with the marks of the rootlets which have been cut off, though these sometimes remain. In this dried state it is inodorous, but has a bitterish taste, which is soon followed by an acrid and burning sensation spreading through the mouth and fauces. Its efficiency as a medicine depends, in part at least, upon the veratria contained in it. There is some reason to suppose that it may contain other active principles, of which, however, too little is known to justify any positive conclusion.

Effects on the System. In its operation on the system, it bears considerable resemblance to the American hellebore, except that it is much more disposed to purge, at least according to the statements of almost all writers on the subject. It has generally been known and treated of as a violent emeto-cathartic, producing severe vomiting and purging, often attended with griping pain, bloody stools, and tenesmus, and not unfrequently with great prostration. It also stimulates almost all the secretions, and is an active local irritant, producing pain and inflammation in mucous and ulcerated surfaces, and that of the denuded skin, and exciting violent sneezing when introduced into the nostrils. In over-doses it acts as an irritant poison, causing an acrid, burning sensation in the mouth, fauces, and œsophagus, a feeling of constriction of the throat, excessive vomiting, purging with bloody stools, tenesmus, severe abdominal pains, a small, feeble, and scarcely perceptible pulse, cold sweats, giddiness, faintness, blindness with dilated pupil, tremblings, loss of voice, insensibility, sometimes convulsions, and death. Occasionally

it is said to produce an eruption on the skin. The reader will have noticed that this series of symptoms is almost precisely the same as that which characterizes the poisonous operation of aconite; and it is probable that they result mainly from the same cause; the absorption, namely, of the active principles of the root, and a sedative influence exerted by them upon the organic nervous centres. It has been ascertained to produce its characteristic effects, not only when taken into the stomach, but when introduced into the rectum, or applied to an ulcerated surface. The production of drastic purging, if this be so common an effect as we are led to believe by the almost universal statements of writers, is a point in which this species of Veratrum differs remarkably from the American; but I suspect that the purging is a less constant phenomenon than is generally supposed; for, in three cases of poisoning by an infusion of the root, reported by Dr. Wm. Rayner, of Stockport, England, this effect was wanting in all. (Pereira's *Mat. Med.*, 3d ed., p. 1062.) The remedies are the same as those for poisoning by aconite.

Therapeutic Application. White hellebore was considerably used by the ancients; but, on account of its violent effects, occasionally even in small doses, has been to a great extent abandoned. The complaints in which it was most used were those of an obstinate character, as *mania*, *melancholia*, *epilepsy*, *dropsy*, *leprosy*, &c., in which its powerful emeto-cathartic effects were supposed to be indicated. It has been employed, at a more recent period, as a substitute for the *eau médicinale d'Husson*, in the treatment of gout; the wine of white hellebore being given in connexion with laudanum; but there are few, I presume, who now continue to use it. As an alterative it has also been given in chronic cutaneous eruptions. I shall hereafter speak of it as an errhine. It has also been employed externally, in the form of ointment or infusion, to destroy vermin about the person, and as a cure for psora. I think it highly probable that, by a proper management of the dose, it might be made to answer the same therapeutic purposes for which the American hellebore has been recommended.

Administration. The dose of powdered white hellebore should not at first exceed one or two grains, which may be repeated or increased if necessary. To produce vomiting, as much as from eight to twenty grains are not unfrequently required; but I think the medicine should never be given with this view. There is an officinal *Wine* (VINUM VERATRI ALBI, *U.S.*; VINUM VERATRI, *Lond.*), the dose of which is ten minims, two or three times a day, to be

increased if necessary, but not so far as to occasion vomiting. It may be given in gout, rheumatism, and chronic cutaneous eruptions. The U.S. Pharmacopœia directs an *Ointment* (UNGUENTUM VERATRI ALBI), which is sometimes used in the itch. The medicine also enters into the London *Compound Sulphur Ointment*, employed for the same purpose.

2. **CEVADILLA.**—SABADILLA. *U. S., Ed.*

This consists of the seeds and capsules of one or more Mexican plants, belonging or closely allied to the genus Veratrum; and it is not impossible that it may be obtained both from *Veratrum Sabadilla* and *Asagræa officinalis*, though it is of late generally referred to the latter. For a description of this product the reader is referred to the U. S. Dispensatory (10th ed., p. 627). Its sole value at present depends on the fact, that it contains veratria in considerable proportion, and yields this alkaloid more readily than any other known substance.

Cevadilla has essentially the same effects on the system as the white and American hellebore, and like them is capable of operating as a poison. Though introduced into Europe so early as 1572, it has never been much used; the chief employment of it being internally as a remedy in tænia and other worms in the bowels, and externally as an ointment for the destruction of vermin. The dose is stated at from five to thirty grains; but, if given at all, the commencing dose should be smaller than the least quantity mentioned, and increased if requisite.

Preparation of Veratria. Veratria is prepared from cevadilla by treating an alcoholic extract of the seeds and capsules with water diluted with sulphuric acid, by which the alkaloid is dissolved, and the sulphate formed in solution. To this, after concentration, magnesia is added, in order to precipitate the veratria. The precipitate having been washed and dried, is then treated with alcohol, which dissolves the alkaloid, and yields it in an impure state on evaporation. It is afterwards purified by boiling with water, sulphuric acid, and animal charcoal, filtering, concentrating, and precipitating with ammonia.

Properties of Veratria. As thus obtained, veratria is a grayish or brownish-white powder, uncrystallizable, inodorous, bitter and extremely acrid to the taste, producing through the mouth and fauces a durable sensation of tingling and numbness, fusible by heat,

scarcely soluble in cold water, soluble in 1000 parts of boiling water, which it renders perceptibly acrid, freely soluble in alcohol, somewhat less so in ether, and capable of neutralizing the acids, with some of which it forms soluble salts. Though inodorous, it produces violent sneezing and coryza. It is characterized by becoming reddened with sulphuric acid, forming a yellow solution with nitric acid, and yielding a white precipitate with tannic acid or ammonia, added to its solution in dilute acetic acid. It is wholly dissipated at a red heat. According to M. Couerbe, the veratria here described is not pure, containing two other principles, which he calls respectively *sabadillia* and *veratrin*, the former possessing alkaline properties. But for medicinal purposes there is no occasion for obtaining it perfectly pure. It consists of nitrogen, carbon, hydrogen, and oxygen.

Effects of Veratria on the System.

Like the substances from which it is obtained, veratria appears to be locally irritant, and, in its general influence, sedative to the organic nervous centres and to the circulation; possessing at the same time emeto-cathartic powers, and the property of stimulating most of the secretions when absorbed.

Rubbed upon the skin, in ointment or solution, it produces a sensation of warmth and tingling, which, according to Dr. Klingner,* is attended with slight shocks like those caused by electricity. If the friction be continued, Dr. Turnbull states that the feeling of heat and tingling is diffused over the whole surface of the body. Sometimes this effect upon the nervous tissue of the part is attended with a transitory redness, and a cutaneous eruption. Dr. J. L. Van Praag† found the tingling sensation extremely painful when the veratria was applied to the umbilicus, where the skin is more delicate. He speaks also of a sensation of cold following the prickling. Applied to the denuded cutis, the alkaloid is powerfully irritant.

Snuffed up the nostrils, even in small quantity and much diluted, it occasions excessive sneezing.

* The facts stated in this article, on the authority of Dr. J. B. Klingner, are contained in a communication by that practitioner to the *Glasgow Med. Journ.*, for Jan. 1854, an epitome of which may be seen in the *Am. Journ. of Med Sci.*, July, 1854, p. 226.

† The results of the experiments of Dr. J. Leonides Van Praag are contained in *Virchow's Archiv.*, Bd. vii. Heft 2, and an abstract of them is given in the *British and Foreign Med.-Chir. Rev.*, for July, 1855, Am. ed., p. 185.

In the mouth and fauces it produces an almost insupportable sense of acrimony.

When swallowed in moderate doses, it produces a feeling of warmth in the stomach, which spreads over the body, probably sympathetically; and, if the dose be increased, nausea and vomiting are induced, sometimes attended, according to MM. Faivre and Leblanc,* with spasmodic pains more or less severe. Very different statements are made in relation to the purgative property of veratria. Magendie states that, in the dose of one-quarter of a grain, it promptly produces abundant alvine evacuations; and its tendency to operate on the bowels is noticed both by MM. Faivre and Leblanc, and by Dr. Van Praag. Dr. Turnbull, on the contrary, states that he seldom found it to purge, even when largely given, and that its action was not unfrequently attended with constipation. When introduced into the intestines of animals, it has been found to produce inflammation of the mucous membrane.

The effects just stated prove the locally irritating property of veratria. The following, I think, no less evince its general sedative influence, at least on the circulation.

After it has been swallowed a short time, the first general feeling of warmth is followed by tingling or prickling more or less extensively through the body, with curious sensations as of currents of heat or cold over the surface; the pulse becomes depressed in frequency and strength; the respiration is also diminished; and one or more of the secretions, particularly those of the kidneys, skin, and salivary glands are notably increased. Dr. Van Praag states that the pulse is early and remarkably reduced in frequency. In the case of a female, to whom he gave one-twentieth of a grain four times in one day, and one-tenth of a grain as often on the following day, the pulse in the first day fell from 90 to 72, and on the second to 64. MM. Faivre and Leblanc state that, whenever it was in their power to examine the pulse before and after the exhibition of the alkaloid, they have found it diminished, and often irregular. They speak also of a general prostration of strength. In experiments upon the lower animals, these observers all agree as to another singular effect from large doses; tetanic contractions, namely, of the muscles of the extremities and of the trunk, which impede respiration, and give rise even to asphyxia. If the dose of the medicine

* The facts stated, on the authority of MM. Faivre and Leblanc, are derived from a communication made by them to the French Academy of Medicine, and published in the *Archives Générales*, Fev. 1855, p. 238.

is poisonous, these effects become immediately manifest. The spasms are at first short and at considerable intervals, but increase in frequency and violence till the animal succumbs, at the end of half an hour or an hour. These effects have not, I believe, been observed in the human subject. Van Praag, in summing up the physiological action of veratria, states that "the respiration and circulation are diminished, the muscles lose their tone, and the irritability of many of the nerves, especially of the peripheral cutaneous nerves, is considerably impaired."

There is little doubt that veratria operates through its absorption. It gives rise to the same general effects to whatever surface applied: operating, according to Van Praag, most rapidly when taken into the stomach, less so when introduced into the rectum, and still less so when in contact with a wound of the skin. It is said, when introduced into the cavity of the pleura, in the lower animals, to produce tetanus and death in a few minutes.

Therapeutic Application.

Van Praag concludes, from his observations of the physiological action of veratria, that it is indicated in febrile disease with augmented tonicity of the muscles; and in pneumonia, pleurisy, and inflammatory affections of the heart. The following are the complaints in which it has been employed.

Acute Rheumatism. In this disease it has been employed with great supposed advantage by M. Pedagnel, of France, who finds the disease generally to get well under its use in seven or eight days. He gives about one-twelfth of a grain, with one-sixth of a grain of the extract of opium, from one to five times daily, according to the demands of the case. According to Dr. Bardsley, of England, the results obtained by treating twenty-four rheumatic patients with colchicum, and the same number with veratria, were absolutely identical. MM. Fabre and Marotte add their favourable testimony as to the efficacy of the medicine in acute rheumatism, and the latter maintains that its good effects are owing to its sedative properties, and are produced equally as well when it occasions no evacuation. (Bouchardat, *Ann. de Thérap.*, 1854, pp. 57–66.) It has been used externally in *rheumatism* and *gout* by Sir C. Scudamore and Dr. Turnbull; but is not applicable, in this way, to the more highly inflammatory conditions of those complaints.

Pneumonia. M. Aran reports several cases of pneumonia, in which veratria proved decidedly useful, administered in the manner

recommended by M. Pedagnel for rheumatism. (*Ibid.*, p. 66.) Considering the asserted efficacy of the American hellebore in this disease, it is quite reasonable to suppose that similar advantage might accrue from the use of veratria, which is probably its active principle.

Chronic Inflammations, and Scrofulous Swellings and Indurations. As an external remedy in these conditions, especially as affecting the joints, veratria has been found extremely useful by Dr. J. B. Klingner. He does not consider it applicable in acute inflammation of the joints; but only after the activity of the disease has passed, and the part is left in an indolent condition. He finds it useful also in dropsy of the joints, and in enlarged bursæ. He employs an ointment made by first dissolving from five to ten grains of the alkaloid in a little alcohol, and then mixing the solution with an ounce of lard; and directs a portion of this, about the size of a small bean, to be rubbed upon the part for fifteen minutes daily, with gentle but steady shampooing at the same time. The benefit is gradual, though slow, and the result sometimes surprising.

Neuralgia. This is probably the complaint in which veratria has been most employed. It is used both internally and externally; but has enjoyed more credit in the latter than the former mode of application. Rubbed, in the form of ointment or alcoholic solution, on the part affected, so as to excite its peculiar tingling effect, it will certainly sometimes afford relief; but it is probably less effectual than the tincture of aconite, which seems to operate in the same way.

Epilepsy, hooping-cough, hysteria, spinal irritation, hypochondriasis, paralysis, and *palpitations*, are other nervous affections in which veratria has been employed; but the testimony in its favour is not such as will be likely to lead to its general adoption as a remedy in these complaints, unless further experience shall prove more satisfactory.

Dropsy. Dr. Bardsley employed it in dropsy, but with no great advantage. Dr. Turnbull found it useful in some instances of the disease, and considers it a beneficial remedy in organic cardiac affections, associated with serous effusion. Ebers employed it endermically as a diuretic, with some relief.

I have had little personal experience with veratria, having never used it in any other method than externally, in neuralgic cases, and having experienced so little benefit from it in these, as to have been discouraged from its further employment.

Administration.

Internally, veratria is generally administered preferably in the pilular form, in consequence of its intensely acrimonious taste, which renders its use in solution disagreeable. The dose is from one-twelfth to one-sixth of a grain, to be repeated every three or four hours, and increased if necessary, until some effect is experienced from it.

An *alcoholic solution*, for external use, may be made in the proportion of a scruple or half a drachm to a fluidounce of officinal alcohol. About half a drachm of this may be rubbed upon the part affected until the tingling sensation is produced; and the application may be repeated two or three times a day, or oftener if necessary, in neuralgia.

A solution in glycerin has also been recommended for external use.

An ointment may be made by rubbing half a drachm first with a fluidrachm of olive oil, and afterwards with an ounce of lard. From half a drachm to a drachm of this may be used two or three times a day.

Two or three grains of the alkaloid may be employed, either in solution or ointment, at one application. Care should always be taken, in its external use, that the skin is not abraded; and it should never be employed unless greatly diluted, in the endermic method. Not more than from one-quarter to one-third of a grain should be applied at first in this manner.

Salts of veratria may be prepared by saturating the alkaloid with the acid more or less diluted, and evaporating to dryness. The sulphate, acetate, and tartrate have been employed. Dr. Turnbull preferred the last as least liable to irritate the stomach. The dose is the same as of the uncombined alkaloid.

VII. BLACK SNAKEROOT.

CIMICIFUGA. *U. S.*

Syn. Cohosh.

Origin. Black Snakeroot is the root or rhizome of *Cimicifuga racemosa* (Actæa racemosa, *Willd., Sp. Plant*), an indigenous, perennial, herbaceous plant, with very much divided leaves, and an erect

stem from four to eight feet high, often branching at top, and terminating in a beautiful, light, feathery raceme of small white flowers. It grows in the woods, or recently cleared grounds, through a large portion of the United States.

Properties. The root consists of a contorted irregular body or rhizome, less than an inch thick, and several inches long, marked by the remains of stems, and furnished with numerous slender radical fibres, externally of a dark-brown colour, approaching to black, internally whitish, with a rather feeble yet quite distinct and characteristic odour when recent, and of a bitter, herbaceous, somewhat astringent, and subacrid taste. It imparts its virtues to water and alcohol, though probably more readily to the latter. Its active constituents have not been isolated; but, considering the smell of the root, and the fact that it deteriorates by time, the probability is that its virtues are, in some degree at least, connected with a volatile principle. Though frequently prescribed in decoction, and not without effect, it is yet deemed to be less energetic in this form than either in substance or tincture; and this corresponds with the view just given of the nature of its active constituent. The sooner after collection it can be used, the more active it will be.

Effects on the System. As the root was popularly employed in pectoral complaints, it was rather hastily concluded, when brought before the notice of the profession, to possess expectorant properties; and its bitterness led to the supposition that it was also tonic. But there is reason to doubt whether it has a decided influence over any of the secretions; and, from the result of recent observations and experiments, I am disposed to think that its proper position is among the nervous sedatives. Dr. Garden, of Virginia, found it to possess "in an eminent degree the power of lessening arterial action," and believed it to have a tonic influence on the system. Dr. Hildreth, of Ohio, also noticed the reduction of the circulation, and found it, in large doses, to produce vertigo, impaired vision, nausea, and vomiting; but never any proper narcotic effect. Dr. N. S. Davis, who has used it largely, never "knew it to produce a perceptible increase of secretion," or to exhibit "the slightest stimulant quality." He remarked the same diminution in the frequency and force of the pulse, and the same symptoms of nervous disorder, from large doses, as were observed by Dr. Hildreth. He found it additionally to allay pain, and relieve nervous irritability; proving that, though it does not derange the intellectual faculties, or produce stupor, it is yet capable of acting on the ence-

phalon. According to Dr. Davis, the reduction in the pulse lasts for a considerable time. These facts seem to show that cimicifuga is a sedative to the nervous and arterial systems, while it may possibly be somewhat tonic to the stomach.

Therapeutic Application. Though long used as a domestic remedy in various disorders, cimicifuga was first brought to the notice of the profession by Dr. Thomas J. Garden, of Charlotte, Va., who employed it with much benefit in *phthisis* and *similar pectoral affections*, and, in his own case, found it to check hectic paroxysms, to diminish night-sweats, to improve the cough and expectoration, and to reduce his pulse from a very excited condition to the normal frequency. Dr. Garden's paper was published in the *American Medical Recorder* for October, 1823; and, in a letter written to the author in May, 1850, he states that thirty years' use of the medicine had fully confirmed his first favourable anticipations. The remedy was also beneficially used by Dr. Charles C. Hildreth, of Zanesville, Ohio, in connexion with compound solution of iodine, in the early stage of phthisis. (*Am. Journ. of Med. Sci.*, N. S., iv. 281.) It is, however, probably useful in pectoral complaints only by allaying irritation through its sedative properties.

In *chorea* black snakeroot has been found very serviceable, and has proved of itself adequate to the cure in a number of instances. In this complaint it was first made publicly known by Dr. Jesse Young, of Chester County, Pennsylvania, who was induced to employ it, from a successful instance of its use in domestic practice, which came under his notice. Having found it effectual upon trial, he published the results of his observation in the *Am. Med. and Surg. Journ.* for February, 1832 (ix. 310); since which period, the medicine has been much employed, and may be considered as among the standard remedies in that complaint. It is proper to state that Dr. Isaac Hays, editor of the Journal just referred to, in an editorial paragraph, appended to the paper of Dr. Young, states that, nearly ten years previously, Dr. Physick had informed him that he had known the same remedy, given in doses of ten grains every two hours, to prove successful in several instances of chorea. Dr. Young gave a teaspoonful of the powdered root three times a day to an adult patient. I have myself frequently used it, and, with so much success, that, in combination with sulphate of zinc and occasional purging, it is the remedy upon which I mainly rely.

In a case of *convulsions* resembling *epilepsy*, occurring monthly in

a young woman about the catamenial period, the paroxysms ceased under the use of this root, which I was induced to try from its effects in chorea. But, though I have since employed it in other epileptic cases, I cannot say that I have known it to be of material service in any other instance.

In *acute rheumatism*, it has been used with extraordinary success by Dr. F. N. Johnson, of New York, who gave it in more than twenty of the worst cases, in all of which "the results were satisfactory in the highest degree; every vestige of the disease disappearing in from two to eight or ten days, without inducing any sensible evacuation, or leaving behind a single bad symptom;" and Dr. N. S. Davis, now of Chicago, who makes this statement, observes in addition; "these trials have been repeated by Dr. Johnson, myself, and others, until we have no more doubt of the efficacy of cimicifuga, in the early stage of acute rheumatism, than we have of the power of vaccination as a preventive of variola." (*Trans. of the Am. Med. Assoc.*, i. 352.) I have had no experience with the remedy in this disease.

Besides the affections above mentioned, cimicifuga has been used with advantage in *hysteria* and *nervous headache.*

Administration. The medicine should be used preferably in substance or tincture. The method of decoction has also been frequently employed; but there is reason to think that the virtues of the root are somewhat impaired in the process. The dose of the powder is from a scruple to a drachm, and may be increased, if thought desirable, until it nauseates or produces vertiginous sensations. It may be given in syrup, or suspended in water. Of the *decoction*, made by boiling an ounce of the bruised root for ten or fifteen minutes in a pint of water, two fluidounces may be given for a dose; and from half a pint to a pint may be taken during the twenty-four hours. Of a *tincture*, made with four ounces of the bruised root and a pint of diluted alcohol, the dose, equivalent to that above mentioned of the powder, is from about one fluidrachm to half a fluidounce. These doses may be repeated three or four times a day in chronic cases. They must be proportionably reduced for children. Dr. Davis states that twenty grains of the powder, or from thirty to sixty drops of the tincture, should be given, in acute rheumatism, every two hours until its effects are observable. (*Ibid.*, p. 356.) If the root is without smell, and of little or no taste, it should be rejected. I have been in the habit of considering the retention of the characteristic odour, as a sufficient test of its activity.

CLASS III.

CEREBRAL SEDATIVES.

I HAVE given this designation to a class of sedatives which act immediately upon the cerebral centres, or those of relation, as well as upon the organic nervous centres, including those which control the functions of respiration and circulation. In other words, they are medicines which directly depress the cerebral as well as the spinal functions, and indirectly those of the lungs and heart. They bear to the nervous sedatives a similar relation to that which the cerebral stimulants bear to the nervous stimulants. The nervous sedatives in their depressing, as the nervous stimulants in their excitant influence, often leave consciousness, intellect, and emotion comparatively little disturbed. The cerebral sedatives, like the cerebral stimulants, powerfully affect these functions, the former directly depressing, the latter directly exciting them. It may at first sight seem strange, that the phenomena produced by these two latter classes, which operate in exactly opposite directions, should to a certain extent be the same. Thus drowsiness, insensibility, and loss of consciousness result both from the cerebral stimulants and cerebral sedatives. But there is this difference, that they are the indirect effects of the former, and the direct effects of the latter. The cerebral stimulants primarily excite the cerebral functions, which subsequently become impaired through the overwhelming congestion of the nervous centres; the cerebral sedatives produce the latter effect immediately, without any preliminary excitation. Under the influence of the one class, the loss of consciousness proceeds from an active congestion of the centres so great as to suspend their function, just as active hepatic congestion suspends the secretion of bile; under that of the other, a similar loss of consciousness follows from a direct diminution of the power to act, just as the liver ceases to secrete when depressed into a state of torpor. But, while the cerebral sedatives thus operate specially upon the functions of the brain, they also, like the nervous sedatives, depress those of the medulla oblongata and spinal marrow, and reduce respiration and circulation; thus differing from the

latter class simply by the superaddition of a more decided cerebral influence. In treating of the cerebral stimulants, I observed that most of them might be employed, in small doses, insufficient materially to affect the brain, for the same purposes as the nervous stimulants. In like manner, the cerebral sedatives, in quantities inadequate to the production of their characteristic cerebral phenomena, may serve the same practical purposes as the nervous sedatives. The more powerful of this class of medicines are extremely dangerous if abused, from their tendency directly to prostrate all the great vital functions. The cerebral stimulants, when given so largely as to destroy life, do so through a previous exaltation of the stimulated centres; and consequently there is an intermediate stage, before the fatal depression can ensue. From the cerebral sedatives, largely given, the danger is immediate. Though there may, therefore, be in nature many substances having the powers which characterize the present class, few of them have been introduced into use. Their powerfully poisonous properties have tended to discourage experiment. Of the therapeutic applications of those in use, it will be sufficient to treat under the articles themselves, as they are severally considered.

Before treating of the several medicines of the class, I will call attention to certain influences, of a mental character, which may often be advantageously applied to similar practical purposes.

MENTAL INFLUENCE AS A CEREBRAL SEDATIVE.

As there are states of mind of a tonic character, such as hope, cheerfulness, &c., and others powerfully stimulant, as anger; so are there feelings of a depressing tendency, of which advantage may sometimes be taken to allay morbid excitement, and which, in the hands of a judicious practitioner, may be made to answer an excellent purpose, especially in nervous affections. Apprehension, fear, despondency, grief, and similar modifications of feeling, have a sedative effect both on the nervous and circulatory systems, which, though not very obvious when the cause is but slight and temporary, may under opposite circumstances become alarming, and, by a long continuance has not unfrequently proved fatal. It is impossible, however, to give precise rules for the remedial management of such influences. This must be left to the judgment of the practitioner, under the guidance of his general therapeutic principles, when the opportunity for their useful employment may offer. It is in disorders of pure nervous irritation that they are most efficient.

Hysterical excitement will often yield to a depressing emotion as to a charm; and the violence of insanity will sometimes give way under the same influence.

Monotony of thought, emotion, or sensation has a singularly soothing effect on nervous excitement, and in health operates strongly in depressing the nervous functions of animal life. Its effect in producing drowsiness, which is a suspension more or less complete of these functions, is well known. Nor is the explanation of its depressing influence difficult. The cerebral centres of thought, volition, emotion, and sensation, like all other living parts of the system, are kept in action by their appropriate excitants, internal or external, deprived of which they cease to act. The centres of themselves are probably powerless. In the ordinary course of life, the agencies which keep them in operation are generally present, during the waking period, and sustain a regular degree of activity. But, if the attention can be turned strongly into one particular direction, so as to abstract from the cerebral centres the mental influences which constitute their proper stimuli, while the object of attention has itself so little interest as not to bring thought or feeling into play, the consequence is that the centres in general fall into a state of repose, while that corresponding to the object of attention, fatigued by its over-exertion, itself sinks into the same condition; and a universal depression of the functions of relation is induced. The person thus operated on becomes at first listless or languid, then drowsy, and at length sleeps more or less profoundly. This occupancy of the attention by one object, or a series of objects of the same nature, is what is here meant by monotony. To count one hundred or one thousand backward; to repeat mentally the multiplication table in a similar direction; to think over a series of sovereigns, or of historical events chronologically, in an ascending or descending scale; to keep constantly present to the mind the most uninteresting event of the day, or the dullest character of one's acquaintance; to listen to a prosy speaker, or to read resolutely a no less prosy book; these, or similar expedients, are often sufficient, not only to induce sleep under ordinary circumstances, but often to overcome very obstinate fits of wakefulness.

The same effect is produced by a similar monotony of impression on the senses. In reference to *hearing*, how often do we see drowsiness induced by simple and constantly repeated melody, as the lullaby of the mother; by the ceaseless roar of the waves upon a beach, of a waterfall, or of a breeze in the pine tops; by the buzz

of insects, or the hum of machinery! Through the *sight*, similar effects are produced by an intent gaze upon a single object, or upon a uniform succession of movement, as the waving of a field of grain, or the manual passes of a mesmerizer, the majestic rolling of the ocean, or the rocking of a cradle. But perhaps the strongest effects of this kind are produced through the sense of touch. A gentle movement of the fingers of another person through the hair, the slight touches of a skilful barber in shaving, the sensation of rocking motion, or the gentle friction of a soft hand upon the surface of the body, often have a wonderfully composing effect. I have not unfrequently seen the restlessness and intolerable uneasiness of nervous debility, or febrile disease, yield entirely to a continuous and quiet movement of the hand of the nurse over the extremities; and a similar friction along the back will often relieve for a time the most violent spinal neuralgia.

The cessation or diminution of habitual impressions upon the senses, has a similar sedative influence. Thus the exchange of the glare and glitter of a town, its unceasing rattle, and clatter, and bustle, for the soft green, and comparative stillness of the country, often produces the most happy effects in calming nervous agitation, and is among our most effectual remedies for purely nervous disorder induced by the artificial life of cities.

Artificial Somnambulism. The powers of the so-called *animal magnetism* or *mesmerism*, which is nothing more nor less than a condition of *artificial somnambulism*, cannot be passed over without notice, in a list of sedative mental influences. That there is a peculiar condition of system induced under the operations of the animal magnetizers, or practical biologists, or by whatever other name they may prefer to be called, I do not think that any one who has carefully and practically examined into the subject can deny. The state is not sleep, though analogous to it. The mental faculties, and emotional functions, and to a considerable degree the sensations, are in a state, as it were, of abeyance. They exist, but are not capable of original and voluntary exercise. The ordinary exterior influences have little or no effect. The internal impulses and motives which usually direct the mental operations have lost their power. The system is a sort of animated machine, which acts through an impulse given it before entering into the condition, or under suggestions made while in it, and continues to act in the direction of these influences without any self-controlling power. A singular attendant upon it is frequently an absence of sensibility to

painful impressions, so that severe surgical operations may be performed without the least apparent suffering to the patient, and often without any recollection of them upon restoration of the ordinary state of the system. The anæsthesia is often as perfect as that induced by chloroform or ether; and it is said, though I have myself seen no case of the kind, that, as in etherization, the insensibility to pain is sometimes established before consciousness is lost. The special senses, on the contrary, though, like the mental faculties and the emotions, not in full exercise, are, like them, susceptible of impressions in accordance with the original direction taken by the mind upon entering the new state, or with suggestions afterwards presented to it from outward sources. The muscular action is under the same influence. It is often exercised in the direction of the original ruling impulse, or in that subsequently given; but otherwise is powerless. Thus, if a limb is moved into any position, it will often retain that position, as in cataleptic persons. Indeed, I do not know how better to express the whole sensorial condition than to say, that it is in a sort of mental catalepsy, moving only as directed by some force exterior to itself. It is not, however, my intention to enter into a thorough consideration of this condition; but merely to treat of it as a therapeutic instrument, the proper application of which requires that it shoud be in some degree understood.

The methods employed to bring the system into this state are such as are calculated to fix the attention on some one object for a considerable time, so as to abstract the mind from all its other functions, which are thus depressed from the absence of their usual excitants, and fall into a sort of imperfect sleep; while the function in exercise becomes enfeebled by fatigue, and in its turn assumes the same condition. The eyes are closed, the body falls back apparently senseless and motionless, the hands usually become cool and moist, and sleep seems to have been induced. But special sensibility and perception are not lost; and, in the absence of any internal but involuntary impression which may serve as an impulse to movement, nothing but a suggestion from without is wanting to guide the whole sensorial faculties into any desired direction; and it is remarkable that, in this direction, the sensorial functions often evince a high and unusual degree of activity, particularly those of the memory and the special senses.

The manipulations employed to induce the condition, the downward passes with the hands from the head along the body and limbs,

the pressure of the hands, and the steady gaze of the operator, are too well known to require minute description. But these special manipulations are not necessary; the great point being to fix the attention and absorb the faculties in one particular direction. Mr. James Braid, surgeon, of Manchester, England, has shown that the same end can be accomplished by fixing the eye, and concentrating the thoughts, as much as possible, upon some one object, especially if this be somewhat above the level of the eye, so as to render an unusual effort necessary to maintain the proper line of vision. I have seen the effect produced by a mere steady look of the operator; and some have the faculty of inducing this condition in themselves by a mental effort.

As a remedy, this agency has often been found useful in promoting sleep in the wakeful; in suppressing the multitudinous nervous disorders of hysteria; in relaxing painful spasm; in subduing neuralgic pains, and those of nervous rheumatism and gout; in curing nervous headache; and in relieving spinal irritation, palpitations of the heart, chorea, hooping-cough, and spasmodic asthma. In producing these effects it probably operates by depressing the nervous centres, thus removing any irritation existing in them, and rendering them insensible to irritant influence from elsewhere; in other words, it operates as a pure nervous sedative. It appears also, that the chain of nervous or mental association which had before sustained, perhaps for a long time, the morbid condition, having been broken, is not always joined again; so that the patient is permanently cured: especially when the process is more or less frequently renewed, as returns of the affection call for it.

Another important therapeutic advantage of this measure is, according to Dr. Braid, the opportunity it affords the practitioner of bringing the whole force of the patient's mind, through the principle of suggestion, to bear upon the desired pathological modification, or therapeutic effect, and thus to add the well-known and long-recognized influence of the imagination to that of the remedy. (See *Ed. Month. Journ. of Med. Sci.*, June, 1851, p. 511, and July, 1853, p. 14.)

I. HYDROCYANIC ACID.

ACIDUM HYDROCYANICUM.

Syn. Prussic Acid.

As hydrocyanic acid is employed in a number of different forms, and obtained from different sources, it will be most convenient to treat first of its general effects on the system, and therapeutic applications, and subsequently of the several forms and sources alluded to, with all that is peculiar to each.

Effects on the System.

In its concentrated state, hydrocyanic acid is one of the strongest poisons known; but, properly diluted and guarded, it is a perfectly safe medicine. With slight local irritant properties, it is a powerful sedative to the whole nervous system, operating with special force on the brain.

In small medicinal doses, it often controls abnormal nervous excitement, without any other observable impression. More largely taken, it occasions a sense of irritation in the throat when swallowed, sometimes nausea, a feeling of confusion in the brain, vertigo, perhaps headache, faintness, dimness of vision, and drowsiness; and all these cerebral symptoms may result from simply smelling a bottle of the strong acid. The pulse is sometimes retarded, sometimes accelerated, but generally if not always weakened. The respiration is also disturbed, being either hurried or diminished. Its direct influence on the nervous tissue is depressing, as evinced by the numbness it produces, and the relief which it sometimes affords to pain. Its sedative powers, however, are much more obvious when it is taken in poisonous doses.

Poisonous Effects. Death has frequently resulted from prussic acid, taken either accidentally, or with a view to self-destruction. The small quantity required, the rapidity of its operation, and the absence of painful effect, have recommended it to the suicide and the poisoner; but the suspicion which sudden death excites, and the means of detection afforded by the odour and chemical reactions of the acid, have had a tendency to deter the latter; so that poisoning by this agent is probably less frequent now than formerly.

Insensibility and death usually take place so soon after a poisonous dose of the acid, that opportunities are not often afforded of

observing the early effect of it in the human subject. It may be inferred, however, from the recollections of those who have recovered, from occasional observation of fatal cases from the commencement, and from various circumstances noticed before or after death implying purposed movements on the part of the patient, that a short period generally if not always elapses, after the application of the poison, before consciousness and the power of action are lost. The symptoms noticed during this interval have been a feeling of heat or acrimony in the mouth and fauces, sometimes nausea with salivation, confusion of head, dizziness, noises in the ears, vertigo, stiffening of certain muscles, constriction of the throat, general weakness, faintness, &c. These, however, are soon lost in complete insensibility or profound coma, which sometimes comes on in from ten to twenty seconds, and is rarely postponed beyond one or two minutes; though a case is on record, in which it did not occur until a quarter of an hour after the taking of the poison.

It is in this condition of insensibility that the patient is usually first seen. The eyes are fixed and glistening, and the pupil generally dilated, and perfectly insensible to light; the respiration is deep, laboured, and slow, sometimes sobbing, and occasionally attended with frothing of the mouth; an odour of prussic acid not unfrequently exhales with the breath; the pulse is extremely feeble, irregular, often imperceptible, and the skin pale or livid, and bathed in a cool sweat; convulsions are very frequent, with tetanic rigidity of the muscles, and especially trismus, though sometimes the body is quiet and motionless; involuntary evacuations occur in some instances; and, finally, death takes place, it may be so early as two minutes from the ingestion of the acid, and generally if not always within an hour. Of seven cases of epileptic patients in one of the Parisian hospitals, poisoned at one time by the exhibition, through mistake, of a strong instead of a weak preparation of prussic acid, all of whom perished, the first died at the end of fifteen, and the last of forty-five minutes. The period is said to be shorter from a large than a small poisonous dose; though there is no fixed relation in this respect.

Should death not take place within an hour, the patient generally survives, waking up as from a deep sleep, and gradually returning to complete consciousness and health. The recovery is usually rapid. It may take place in half an hour, or be postponed for three or four hours. Sometimes vomiting takes place with returning

sensibility, and probably proves salutary by the evacuation of the poison.

The lowest quantity which has been known to cause death is, I believe, nine-tenths of a grain of the anhydrous acid, equivalent to about forty-nine drops of the diluted acid of the U. S. and London Pharmacopœias. So small a quantity as thirty-six drops of the latter has produced the most violent and threatening symptoms of poisoning, from which, however, the patient recovered. Occasionally a considerably larger amount has been taken without causing death. Dr. Taylor, in his *Treatise on Poisons* (Lond., A. D. 1848, p. 672), states that the largest dose of the anhydrous acid, from which recovery is known to have taken place spontaneously, is one grain and a half, equal to somewhat more than a drachm of the diluted acid.

Attention has been called by Dr. Chanet to a kind of chronic poisoning from prussic acid, produced by frequent exposure to its vapours, in quantities insufficient to cause immediate death, as in certain manufacturing processes. The symptoms are dull pain in the head, darting pains over the eyes, abnormal sounds in the ears, dizziness, vertigo, pain in the precordial region, difficult respiration, constriction of the throat, feelings as of suffocation, and alternate wakefulness and somnolency. (*Gaz. de Hôpit.*, Juil. 24, 1847.)

It has been questioned whether hydrocyanic acid has, like digitalis, the cumulative property; whether, in other words, having been given for some time in regularly successive doses, without observable effect, it suddenly acts at last with the accumulated force of the whole, or a considerable portion of the quantity taken. I have never seen any tendency of this kind from hydrocyanic acid, and do not think that it need be apprehended, with due care not to increase the dose to an amount which might itself prove hazardous. There may be a temporary insusceptibility to the action of the poison, which may at length suddenly cease; and a dose which, a short time previously, would not have been felt, might now prove dangerous. But it is the last dose here that acts, and not the accumulated doses before taken. The influence of the poison is too brief for this danger; and, if it do not operate within a few hours, it will probably be decomposed or eliminated without effect.

After death, the odour of prussic acid sometimes exhales from the body, and is often strongly perceived upon opening the stomach. It is said also to be occasionally discoverable in the blood, and the different cavities. The reader must not confound

this odour with that of the oil of bitter almonds. To me the two are quite distinct. The latter smell might lead to the suspicion that hydrocyanic acid had been swallowed in connexion with the oil, with which it is generally associated; but it would afford no proof of poisoning with the pure acid. The only marked phenomenon presented, upon post-mortem examination, is a universal venous congestion, proving that the circulation had been arrested in the lungs. The blood is usually found dark, and either fluid or imperfectly coagulated. It is said that marks of inflammation exist in the stomach and bowels; but death is often too rapid to permit the establishment of this process, and the redness which has been ascribed to inflammation is probably owing simply to venous congestion.

Treatment of Poisoning by Hydrocyanic Acid. Unhappily, the opportunity for interposing remedies is seldom offered, in consequence of the speedy occurrence of death. The prominent indications are to support or restore the respiratory function, and to obviate the debilitating influence of the poison until it shall cease to act. To neutralize or evacuate the acid is also desirable, and should be aimed at when the opportunity is offered; but too often the case ends fatally before the requisite measures can be carried into effect; and the closure of the mouth, and the inability to swallow, are impediments in the way of their application. The most effective measure is probably to dash cold water upon the face, head, or shoulders, or to pour it upon the spine. This, by the shock, rouses the nervous centres, and favours the restoration or continuance of respiration. For the same purpose, carbonate of ammonia, or the aromatic spirit of ammonia, should be applied assiduously to the nostrils; the latter remedy should be administered by the mouth, if the patient can swallow, or by the rectum if he cannot; and stimulation externally should be resorted to by friction and rubefacients. Chlorine has been recommended as an antidote, and, if it can be obtained in time, it may be administered in the form of chlorine water, or perhaps dilute solution of chloride of lime. Another antidote has been recommended, consisting of the mixed sulphates of protoxide and sesquioxide of iron, which must be preceded by a solution of carbonate of potassa. The common sulphate of iron of the shops may be employed, as it really contains the two oxides. An insoluble and inert ferrocyanuret of iron or Prussian blue is formed, and the hydrocyanic acid neutralized. The two solutions, the alkaline, namely, and the chaly-

beate, may be introduced successively into the stomach by injection, if the patient cannot swallow. Should there be any disposition to vomit, it should be favoured by warm drinks. Should respiration have ceased, it must be restored artificially; and efforts may be made to rouse the vanishing action of the heart by means of the electro-magnetic influence.

2. *Mode of Operation.*

Until lately, it has been supposed that hydrocyanic acid operated, through nervous communication, upon the brain; the rapidity of its action precluding, as it was imagined, the supposition that it could produce its effects through absorption. At present the general opinion tends towards the view, that it operates on the system exclusively through the circulation; and I have myself little or no doubt that this view is correct. *In the first place*, there can be no doubt that the medicine is not only absorbed, but rapidly so. Its odour in the breath of one who has swallowed it, and in the blood and the cavities of the body after death, its discovery in the blood by chemical tests, and the fact that it operates in the same manner to whatever absorbing surface it may be applied, are sufficient proofs to this effect. *Secondly*, experiments have proved that, however speedy may be its operation, as for example in three or four seconds when inhaled into the lungs of a small animal, yet the movement of the blood is sufficiently rapid to allow time for its absorption and conveyance to the brain. *Thirdly*, it is not prevented from acting, when applied to the tongue or stomach, by cutting off the nervous communication between these organs and their nervous centres. *Lastly*, if the circulation of the blood be arrested from the place of its application, it produces no effect. The fact, moreover, that it operates more rapidly when inhaled than when applied in any other mode, whether by the stomach, rectum, or a wound, favours the idea of its absorption; as the air-cells of the lungs afford a readier entrance into the circulation than any other surface; and the distance, by the route of the circulation, thence to the brain is shorter than from any other point of application, even the jugular veins.

The strong acid dropped into the eye, placed upon the tongue, introduced into the stomach or rectum, applied to a wound, or injected into one of the serous cavities, or into the blood of one of the lower animals, usually produces death, and sometimes in a few seconds, so that the action seems almost immediate. The animal generally dies with convulsions.

The heart continues beating after respiration has ceased. Dr. Pereira states that he had examined a considerable number of animals destroyed by hydrocyanic acid, and had met with no instance in which the heart had ceased to beat, when the chest was opened immediately after apparent death. According to the same observer, the voluntary muscles, too, retain their irritability, contracting under the application of galvanism, though the contrary has been noticed by some others. (*Mat. Med.*, 3d ed., p. 1796.)

From the above facts, it may be inferred that the acid operates directly on the cerebral and spinal centres, and indirectly upon the lungs and heart, probably first suspending respiration through the want of the proper nervous influences to the pulmonary function, and secondly arresting the heart's action through the want of blood from the lungs. Death, therefore, takes place from asphyxia. Hence the general venous congestion observed after death, affecting the brain, lungs, abdominal viscera, &c. The insensibility, however, is the antecedent of the asphyxia, and depends not upon the want of blood in the brain, but upon the immediate paralyzing influence of the poison.

The convulsions serve in no degree to prove an irritant action of the acid; for the same effect is produced by a very copious loss of blood.

It would seem also that hydrocyanic acid has a direct sedative effect on the nervous peripheries; for numbness and relief of pain have sometimes resulted from its local action, without any apparent influence on the brain.

3. *Therapeutic Application.*

Hydrocyanic acid is chiefly calculated to meet the two indications of allaying nervous irritation, and controlling the action of the heart. It is sometimes also employed to relieve pain.

In *inflammations*, it is of little use during the stage of highest action; but sometimes, when the heart remains unusually irritable, after the local excitement has in great measure yielded or been subdued, it may be employed with advantage to calm the circulation. In the *pulmonary inflammations*, it also acts beneficially by quieting the cough, for which purpose it may be substituted for opium, when the latter medicine is contraindicated by its property of checking bronchial secretion. It is most conveniently used, in connexion with expectorants and demulcents, in the form of cough mixtures.

In various *nervous diseases* it has been extensively used. At one time it had great reputation in *pertussis*, and was even thought to be adequate to the cure of that affection; but experience has shown that it is useful only as a palliative; and, even in this respect, it has no advantage over the cerebral and nervous stimulants, as belladonna and assafetida. It has also been employed in the paroxysm of *spasmodic asthma;* but it is quite unequal to the violence of this complaint, unless employed in doses which might prove hazardous; and the disease is, therefore, left to safer medicines. Indeed, this is the great disadvantage of hydrocyanic acid, that it cannot be given so as to produce a vigorous therapeutic impression, without the danger of inducing its poisonous effects; a disadvantage which it shares with all the most powerful cerebral and nervous sedatives, but which, in consequence of the great rapidity and violence of its action, belongs to it in greater degree probably than to any other. We are, therefore, compelled to satisfy ourselves with those milder curative influences which can be obtained from small and safe doses. *Nervous cough* sometimes yields very happily to the medicine.

But it is in *diseases of the heart* that hydrocyanic acid exhibits, I think, its most valuable powers. In the more violent inflammatory affections of the organ or its investing membranes, or in the excessive excitement of high febrile disease, it will do little good in safe or prudent doses; nor is it adequate, in such doses, to the control of strong hypertrophic action; but in *palpitation* and other irregularities in the function of the organ, of no very energetic character, whether purely nervous, or associated with organic disease, I know no medicine better calculated to alleviate the disturbed function, and afford ease and comfort to the patient. I use the officinal diluted acid habitually in such cases, in the dose of two or three drops every two or three hours, in emulsion of sweet or bitter almonds, and often find it to afford relief, after failing with the more powerful action of digitalis. It may be used also in *aneurism of the aorta;* but, as the indication here is rather simply to reduce the circulation than to regulate it, more good may be expected from digitalis, or the arterial sedatives. It is the element of nervous disturbance in the heart's derangements, that hydrocyanic acid is peculiarly calculated to control.

Some years since, much was expected from hydrocyanic acid in *phthisis;* and the remedy was often used without due regard to its poisonous powers. While in the height of its vogue in Philadelphia, I happened to hear of two cases of this disease, in which it

was supposed to be the immediate cause of death. Such accidents deterred from its continued use, and it has fallen into neglect in the treatment of this disease, at least in its ordinary medicinal form; though, as it exists in wild cherry bark tea, it is still much and advantageously employed in this country. Its influence in quieting cough, and in calming the excessive frequency of pulse so common in phthisis, renders it useful as a palliative, and adjuvant of other measures; and its connexion with a tonic principle, in the bark just alluded to, gives peculiar efficiency to that medicine. Next to cod-liver oil, there is no one medicine upon which I am disposed to place more reliance, in the treatment of phthisis, than upon the wild cherry bark, or Prunus Virginiana of our national Pharmacopœia.

Gastric Pains. In the neuralgic pains of the stomach so frequent in *dyspepsia*, whether in the form of *gastrodynia*, *gastric spasm*, or *pyrosis*, hydrocyanic acid is much esteemed by many British practitioners. It is said sometimes to act with great promptness and efficiency in the relief of those pains, when purely nervous; and it has been recommended also in similar affections of the bowels. It has been employed, moreover, in ordinary *cholera morbus*, and in *epidemic cholera;* but, in the latter at least of these affections, it can be of little service in any safe dose.

Externally it has been found useful in allaying the itching and irritation of certain cutaneous eruptions, such as lichen, prurigo, eczema, impetigo, &c. The mode of its application will be mentioned, under the several preparations or forms in which the medicine is used.

Forms in which Hydrocyanic Acid is Used.

Pure anhydrous hydrocyanic acid is so powerful, and so extremely dangerous if abused, and withal is so liable to spontaneous change, and therefore to uncertainty of strength, that it has been discarded from the officinal lists, and should not be kept in the shops. The medicine should be used only in the dilute form, either as nature offers it to us in various vegetable products, or as prepared according to the direction of the officinal codes. Numerous plants belonging to the genera *Cerasus*, *Prunus*, and *Amygdalus*,—the *cherry*, *plum*, *almond*, *peach*, &c.—yield hydrocyanic acid in connexion with a peculiar volatile oil, when treated with water. The bark, leaves, blossoms, and kernel of the fruit are the parts from which these products may be most abundantly obtained. All these parts have a peculiar aromatic odour, and a not

unpleasant bitterness, which they owe in part at least to the associated acid and oil alluded to, and which are quite characteristic. Neither the hydrocyanic acid nor the oil exists, in any considerable proportion, in the parts of the plants mentioned; but both are the product of a reaction between a principle contained in the plant, and water. The principle referred to is a bitterish substance denominated *amygdalin*, which, through the agency of another substance, of nitrogenous composition and albuminous character, denominated *emulsin*, also contained in the plant, and with the presence of water, is converted into hydrocyanic acid and a volatile oil, which come over together in distillation, and which, thus obtained, are identical with the well and long-known *essential oil of bitter almonds*. The emulsin acts merely as a kind of ferment; the real change taking place between the amygdalin and the water. Hence it is that the various vegetable products mentioned, when quite dry, are destitute of the characteristic odour; and they have the characteristic taste and effects on the system, when swallowed, only because they find, in the saliva and the gastric liquids, the water necessary to the formation of the new bodies. The following are the parts of these plants officinally recognized, along with their several preparations; the wild cherry bark, which has already been treated of among the tonics, being omitted. After these will come an account of the several officinal preparations of the hydrocyanic acid itself.

I. BITTER ALMONDS.—AMYGDALA AMARA. *U.S., Ed.*

These are the kernels of the fruit of *Amygdalus communis*, variety, *amara*, or bitter almond tree, growing wild in Persia, Syria, and the North of Africa. They are brought chiefly from Mogadore, in the empire of Morocco. All that is here said of the bitter almond is equally applicable to the kernel of the common peach, or fruit of *Amygdalus Persica*.

Bitter almonds, when perfectly dry, have little or no smell, but, when rubbed with water, acquire a strong odour like that of the peach blossom. Their taste is of a peculiar not unpleasant bitterness. With water they form an emulsion which contains all their active properties. They are chiefly employed to impart flavour in confectionery and cookery; but sometimes also to obtain the medical effects of hydrocyanic acid. Their emulsion is used in the cough of catarrh and phthisis, also as a lotion in skin affections, to allay itching, tingling, &c. They act in these affections partly

through their demulcent properties, but chiefly through the hydrocyanic acid generated in them with the presence of water. To prepare the *emulsion*, half an ounce of the almond or peach kernels is to be rubbed with half a drachm of gum arabic, two drachms of loaf sugar, and eight fluidounces of water, and the liquid then strained. The dose is a tablespoonful. Bitter almonds are also an ingredient in the officinal *syrupus amygdalæ*, or *syrup of orgeat*, which, therefore, forms a good addition to cough mixtures. Besides this, there are two officinal preparations of bitter almonds, and one non-officinal, which require a brief notice.

1. OIL OF BITTER ALMONDS.—OLEUM AMYGDALÆ AMARÆ. *U. S.*

This is obtained by distilling with water bitter almonds, previously deprived of their fixed oil by expression. It is of a yellowish colour, with a strong odour of the kernels, and a bitter, acrid, burning taste. It is soluble in alcohol and ether, and slightly so in water. It consists mainly of hydrocyanic acid, dissolved in or combined with a volatile oil, upon which its peculiar odour and taste chiefly depend. When freed from the former ingredient, it has the ordinary properties of the volatile oils, and retains its smell and taste, but is no longer poisonous. When taken internally in its original state, it produces on the system all the effects of hydrocyanic acid, and has the advantage, as a medicine, over the pure diluted acid, that it will keep for a long time without any material deterioration; the oil acting as a preservative to the active ingredient. It is, indeed, a very convenient form for the administration of the acid. The dose is from one quarter of a drop to a drop, given at the ordinary intervals, and cautiously increased, if necessary, until some effect is experienced. It is most conveniently administered in emulsion with gum arabic, loaf sugar, and water, and may be applied externally to irritating cutaneous eruptions, either in the same form, or dissolved in water, in the proportion of one minim to the fluidounce, through the intervention of a little spirit. It is so poisonous, that four drops of it are said to have killed a dog of medium size.

2. BITTER ALMOND WATER.—AQUA AMYGDALÆ AMARÆ. *U. S.*

This may be prepared either by distilling water from bitter almonds, or, as directed in the U. S. Pharmacopœia, by dissolving the volatile oil of bitter almonds in water, through the intervention of carbonate of magnesia; one minim of the oil being used to two

fluidounces of water. The latter method is preferable, as yielding a more uniform product. As the preparation is liable to change upon being kept, it should be made in small quantities at a time, as wanted for use. It may be used as a vehicle for other substances, when hydrocyanic acid is at the same time indicated, as in nervous coughs, palpitation of the heart, and various spasmodic complaints. The proportions of the mixture should be so arranged, that a tablespoonful may be given for a dose to an adult. The preparation made by distilling the almonds is of uncertain strength, and should be discarded. It is said to have been prescribed with fatal effects.

3. AMYGDALIN.

This is procured from bitter almonds. For an account of the process the reader is referred to the U. S. Dispensatory. It is a white, crystallizable substance, inodorous, of a sweetish bitter taste, freely soluble in water and hot alcohol, slightly so in cold alcohol, and insoluble in ether. When mixed with emulsin and water, it is converted into the oil of bitter almonds, altogether identical in properties with that obtained by distilling the fruit. Now, as emulsin is contained in sweet almonds, it follows that a preparation may be made, having the effects of hydrocyanic acid, by rubbing together a little amygdalin, sweet almonds, and water, so as to form an emulsion. Wöhler and Liebig recommend that 17 grains of amygdalin should be added to a fluidounce of emulsion of sweet almonds, prepared with two drachms of the fruit. The dose would be from thirty minims to a fluidrachm. As amygdalin keeps well when dry, a preparation of uniform strength could thus be obtained when wanted. Amygdalin itself produces no poisonous effect when swallowed; as there is nothing in the stomach which can act the part of a ferment like emulsin; nevertheless, it should not be swallowed largely, lest by accident something might have been taken having this property.

II. CHERRY-LAUREL LEAVES.—LAURO-CERASUS. *Ed.*, *Dub.*

These are the leaves of *Cerasus Lauro-cerasus*, De Cand. (*Prunus Lauro-cerasus*, Linn.), or the common European *cherry-laurel*, a small evergreen tree, indigenous in Asia Minor, but naturalized throughout the temperate parts of Europe, where it is also cultivated for medical and ornamental purposes. The fresh leaves, when entire, have little if any smell, but, when bruised, emit an odour like that of moistened bitter almonds, and have the same bitter taste. By distillation with water they yield also a similar product.

Cherry-Laurel Water (AQUA LAURO-CERASI, *Ed.*, *Dub.*) is made by distilling the fresh leaves of the cherry-laurel with water. In order to aid in its preservation, a little alcohol is often added. The Ed. Pharmacopœia directs the compound spirit of lavender for the purpose. Though considerably employed on the continent of Europe, for similar purposes with diluted hydrocyanic acid, it is at best an uncertain preparation, liable to change on keeping, and therefore not to be relied on. The dose is from thirty minims to a fluidrachm.

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III. DILUTED HYDROCYANIC ACID.—ACIDUM HYDROCYANICUM DILUTUM. *U. S.*, *Lond.*, *Ed.*—ACIDUM HYDROCYANICUM. *Dub.*

This is the form in which hydrocyanic acid is ordinarily used. It is procured in various methods. In the U. S. Pharmacopœia, two processes are given, one for procuring it on the large scale for keeping, the other on a small scale as wanted for use.

Preparation. According to the first method, ferrocyanuret of potassium, sulphuric acid, and water are distilled together; the resulting vapour is received in water, which condenses it; and then so much distilled water is added to the distilled product, as to make it of a fixed strength. In this process, a portion of cyanuret of potassium of the ferrocyanuret reacts with sulphuric acid, so as to produce bisulphate of potassa and hydrocyanic acid, the potassium being oxidized at the expense of the water, and the cyanogen combining with its liberated hydrogen. There is left behind a compound of two eqs. of ferrocyanogen with one only instead of two eqs. of cyanuret of potassium.

By the second method, cyanuret of silver is mixed with a fixed proportion of muriatic acid and water, the mixture is shaken, and the clear liquid poured off from the precipitate which forms. The hydrogen of the acid combines with the cyanogen of the cyanuret, to form hydrocyanic acid; while the liberated chlorine and silver unite to produce the insoluble chloride of the metal. The cyanuret of silver, used for this purpose, is procured by receiving the vapours of hydrocyanic acid, as distilled over from the materials in the first process, in a solution of nitrate of silver, and washing the precipitate formed.

Properties, &c. The diluted acid prepared by either of the above methods contains only two per cent. of the pure anhydrous acid. It is a colourless transparent liquid, having a peculiar odour, quite

different from that of the oil of bitter almonds, and a cooling slightly acrid taste. As it is decomposed by light, it should be kept in opaque bottles, which should be small, and well stopped. Hydrocyanic acid consists of one equivalent of cyanogen (2 eqs. carbon and 1 of nitrogen) and one of hydrogen.

This preparation is *incompatible* with the soluble salts of silver, copper, and mercury, forming with them insoluble cyanurets of the metals respectively.

It is said to have proved fatal, in one instance, in the dose of forty-nine minims; and thirty-six minims have produced very threatening symptoms. Its presence may be detected by adding to the suspected liquid first solution of potassa, next a solution of the common sulphate of iron of the shops, containing both protoxide and sesquioxide of iron, and lastly a little sulphuric acid to dissolve any superfluous oxide of iron. If hydrocyanic acid be present, the deep blue ferrocyanuret of iron will be generated.

Administration. The dose of diluted hydrocyanic acid is from two to six drops. I usually begin with two drops every two hours, gradually increasing until some effect is obtained, and then regulating the amount of the dose and the interval so as to maintain the desired impression. The medicine may be given in distilled water, sweetened water, or mucilage. I often prescribe it with emulsion of sweet almonds, sometimes adding a little of the bitter almond to give flavour to the preparation, and so managing the proportions that a tablespoonful of the emulsion (see *Mistura Amygdalæ*, U.S. Disp.) shall contain a dose of the diluted acid. If headache, confusion of brain, giddiness, faintness, or epigastric uneasiness should be produced, the dose should be lessened. It is safest, on no occasion, however gradually the dose may be increased, to exceed twenty minims at once.

IV. CYANURET OF POTASSIUM.—POTASSII CYANURETUM. *U. S.*

Preparation. Cyanuret of potassium is prepared by igniting together ferrocyanuret of potassium and carbonate of potassa. The carbonic acid escapes; a portion of the cyanogen combines with a portion of the potassium to form cyanuret of potassium; the liberated oxygen of the potassa combines with another portion of cyanogen to form cyanic acid, which then unites with an undecomposed portion of potassa; and the iron which is separated falls to the bottom of the melted mass. The liquid portion, being now poured off,

and allowed to cool, constitutes the salt in question, mixed with a small and insignificant proportion of cyanate of potassa.

Properties. Thus made, cyanuret of potassium is in white, opaque lumps, with a sharp somewhat alkaline taste, combined with that of hydrocyanic acid, deliquescent, very soluble in water, and slightly soluble in alcohol. Exposed to the air, it exhales an odour of hydrocyanic acid, owing probably to its decomposition by the carbonic acid of the atmosphere. It has an alkaline reaction. Almost any acid will decompose it, liberating the hydrocyanic acid. Hence, by the addition of an acid to it at the time of exhibition, the effects of hydrocyanic acid can always be obtained; and the same result would almost always follow its administration, even without previous admixture with an acid, as there is usually sufficient acid for the purpose present in the stomach.

Effects. It is highly poisonous in over-doses, acting precisely as hydrocyanic acid. Whether it would produce these effects without the reaction of an acid is not certainly known; but it should never, under any circumstances, be ventured upon in poisonous doses. Some years since, a physician in France prescribed a three ounce mixture containing 72 grains of the cyanuret of potassium; a tablespoonful, containing about 12 grains of the salt, to be taken three times a day. At the first dose, the patient fell as from a stroke of lightning, and died in three-quarters of an hour. The prescriber was condemned to pay a fine of 50 francs, and to be imprisoned for three months. (*Journ. de Pharm.*, 3e sér., iii. 82.)

Administration. The dose is one-eighth of a grain, dissolved in a fluidounce of distilled water, with the addition of a little dilute acetic or citric acid, either pure or in the form of vinegar or lemon-juice. It may be repeated and increased, in the same manner as the diluted acid itself. It was proposed as a substitute for hydrocyanic acid, on the presumption of its greater certainty and uniformity of strength; and this recommendation would be well-founded, could we always be assured of the purity of the preparation used. But this is by no means the case. It may be used externally also, as a sedative lotion, in the proportion of from one to four grains to a fluidounce of water; and the stronger solution may be employed for removing stains left on the conjunctiva by nitrate of silver, a drop being applied every other day. Care must be taken not to apply this solution, or any other liquid preparation of hydrocyanic acid, too freely to abraded or mucous surfaces.

II. CHLOROFORM.

CHLOROFORMUM. *U. S., Dub.*—CHLOROFORMYL. *Lond.*

Discovery. Chloroform was discovered in the year 1831, by Mr. Samuel Guthrie, of Sackett's Harbour, New York, and about the same time by Soubeiran, in France, and Liebig, in Germany; but the precise chemical nature of the product was not understood, till determined by Dumas in 1834. By that chemist it was ascertained to be a compound of three eqs. of chlorine with one eq. of a bicarburet of hydrogen called formyle, or, in other words, to be a *terchloride of formyle.* Mr. Guthrie, mistakingly supposing that the substance obtained by him was the Dutch liquid, or *chloric ether* of Dr. T. Thomson, gave it the latter name, which is still, though very erroneously, often applied to its alcoholic solution.

Preparation. According to the directions of the U. S. Pharmacopœia, chloroform is obtained by distilling a mixture of chlorinated lime (chloride of lime), water, and alcohol. Two liquids are condensed in the receiver, the heavier of which is chloroform. This, having been separated, and washed successively with water to remove alcohol, and a solution of carbonate of soda to remove chlorine, is agitated with dry chloride of calcium in order to separate the water, and then again submitted to distillation. The product now obtained is pure chloroform. It is generated by reaction between alcohol and the chlorine of the chlorinated lime.

Properties. Chloroform is a limpid, colourless liquid, of a fragrant, ethereal, apple-like odour, and a warm, sweet, somewhat pungent, and agreeable taste. It rapidly volatilizes on exposure, and boils at 142° Fahr. It is not inflammable. Its specific gravity is 1.49. When thrown into water it sinks rapidly, forming as it falls distinct globules, which have a characteristic appearance. It is very slightly soluble in water, requiring for solution 2,000 parts of that liquid, to which nevertheless it distinctly imparts its peculiar odour. Alcohol and ether readily dissolve it; and its alcoholic solution, if not containing more than about ten per cent. of chloroform, mixes with water without being decomposed, and forms a liquid of a sweet, aromatic, and grateful taste. It has itself extraordinary solvent powers; dissolving not only most of the substances soluble in alcohol, such as the volatile oils, resins, camphor, &c., but also some which are not so, or but imperfectly, as gutta

percha, caoutchouc, and wax. The cohesion between its particles must be feeble, as it yields a greater number of drops from a certain measure than any other medicinal liquid; one fluidrachm giving on an average 240 drops.*

Its sensible properties, great specific gravity, behaviour with water, volatility without residue, low boiling point, and incombustibility, sufficiently distinguish it from all other bodies.

1. *Effects on the System.*

Chloroform, in its local action, is first irritant and afterwards sedative; in its general influence is powerfully sedative, primarily to the nervous system, and secondarily to the respiration and circulation. When it first became known as a medicine, I was disposed, with others, to consider it a stimulant of the same class as ether, alcohol, and opium; but I soon found that it was impossible to reconcile some of its most obvious effects with this view of its powers, and, having made a more particular investigation into its operation, became convinced that it was directly and essentially sedative to the nervous system generally, and especially to the brain. In a number of patients, to whom I gave it internally, in doses of from thirty to seventy drops, I could detect no evidence of increase in the cerebral functions, or in the action of the heart, but found it moderately sedative to both. A young medical gentleman, who took a fluidrachm of it, assured me that he experienced no mental excitement, though a pleasing calmness was induced, with some cerebral confusion, and a feeling of drowsiness. The pulse was at no time in the least accelerated, but soon became somewhat less frequent; nor was there any heat of skin, or hurry of respiration. Dr. Henry Hartshorne, at the time resident physician in the Pennsylvania Hospital, made various trials with it upon himself, and in the wards under my care, with the same results. "From seventy-five drops of it there was a diminution of consciousness and sensorial capacity; sight, hearing, and touch became less impressible; and positive drowsiness was produced. There was no feeling of exhilaration or disorder; and the pulse, so far from being accelerated, was reduced two beats in the minute." (*Am. Journ. of Med. Sci.*, Oct. 1848, p. 353.)

* In reference to this point, Prof. Procter, at my request, made numerous trials with bottles of differently-shaped mouths, such as are usually employed for holding medicines. The highest number of drops yielded by a fluidrachm of pure chloroform was 255, and the lowest 230. From a glass phial with a recurved lip, which always yields unusually large drops, he obtained 160 to the fluidrachm.

What would be the effects of doses larger than a fluidrachm, internally administered, I have never tried; and, so far as I have been able to discover, reports upon the subject are very meagre. M. Aran has recorded a case in which a quantity, supposed to be from eight to ten drachms, was swallowed in mistake by a man. There was at first a burning sensation produced, with ineffectual efforts to vomit; in a few minutes afterwards he was found with his eyes glistening, his features animated, singing and talking incoherently, and unable to recognize those about him. There were some convulsive movements; the skin was insensible to painful impressions; sight was lost; and the pulse was between seventy and eighty. In the course of twenty or thirty minutes sleep ensued, which became very deep, and was attended with insensibility of the surface, and complete relaxation; the respiration and circulation remaining normal. The sleep continued several hours. Next day he could remember nothing of what had passed, and the unpleasant symptoms gradually disappeared. (*Bull. de Thérap.*, xlii. 296.)

In consequence of its locally irritant property, it not unfrequently occasions nausea and vomiting, especially when not thoroughly suspended, and equally distributed in the vehicle in which it is given. Its weight and insolubility probably produce this effect, causing it to fall against the surface of the stomach, and thus to act in an undiluted state upon the mucous membrane. By proper administration, this effect may, to a considerable extent, be avoided. Nevertheless, in my experience, it is the strongest objection to the internal use of the medicine, which, so far as its influence on the system is concerned, may, I believe, be given with perfect safety in any moderate dose.

Local Effects. When applied to any sentient part, chloroform produces at first a painful burning sensation, with more or less rubefaction, and, as some assert, vesication, though I have never witnessed this effect. In a short time the irritation ceases, and is followed by a more or less entire loss of sensibility in the part, with relief to any existing pain, which is often surprisingly sudden and complete. The irritant impression is of course stronger upon the mucous membranes, or an abraded surface, than on the sound skin, in which, however, when the chloroform is undiluted, the smarting and burning are often severe. Some degree of the same effect is produced by the vapour, similarly applied; though much less considerable. Diluted to a much less extent than as it must exist in the circulation, the medicine quite loses this irritant pro-

perty, and becomes perfectly bland; so that the possession of the property by no means implies that the chloroform, when absorbed, will in the slightest degree excite the parts with which it is brought into contact. The local anæsthetic power of chloroform was noticed by MM. Flourens, Serre, and Longet, who, in their experiments upon animals, observed that, when applied to the extreme nerves uncovered, it rendered them completely insensible. But credit is more particularly due to Dr. Nunneley, for having drawn attention to this property, not only in chloroform, but in other agents also, and for showing that advantage might be taken of it for practical purposes. He proved that the insensibility was not confined to the precise locality of the application, but extended also a considerable distance along the nervous trunk.

Effects from Inhalation. When the vapour of chloroform is inhaled, it first produces an irritant impression on the mucous membrane of the air-passages, which, however, is inconsiderable, and scarcely more than momentary, and is soon followed by a local torpor and relaxation, dependent probably upon the direct contact of the agent. But all merely local effect is very speedily absorbed in the powerful impression made on the system. The inhalation may be effected by simply holding the chloroform in the vicinity of the mouth and nostrils. The vapour enters with the air inspired. When but a small quantity of the liquid is employed, as from twenty to thirty minims, its effect begins to be felt in the head within a few seconds. The brain becomes somewhat confused, abnormal sounds are heard, sight is disordered, a vague sense of pleasure is experienced, hallucinations, generally agreeable, and sometimes apparently ludicrous, are experienced, and a loss of consciousness, more or less complete, takes place, generally with quiet sleep, but occasionally with dreamy, incoherent speech, or laughter, and very rarely turbulence. Consciousness returns in five or six minutes, with either no recollection, or a confused one of what had passed. If the quantity used is somewhat larger, say one or two fluidrachms, the effect is more rapid and powerful. Feelings of an agreeable character are soon followed by diminished sensibility, general numbness, mental obtuseness, drowsiness, complete loss of consciousness, and profound sleep. The eyelids droop; the pupils are dilated, though contractile, and roll upwards; the breathing is slow, often stertorous, and sometimes with frothing at the mouth; sensibility and the power of movement are quite lost; and the muscles are in general universally relaxed, though in rare instances slight convul-

sive twitchings of the face and limbs are observable. The pulse is sometimes momentarily quickened at first, though enfeebled; more frequently it is diminished both in frequency and force; and in some instances it becomes extremely weak. In general, however, it is not very materially affected, unless the application be continued longer than necessary to induce sleep. From the state of deep stupor or coma, the patient usually passes, for a short time, into a soft sleep, or dreamy drowsiness before fully awaking; but not unfrequently there is an immediate return to complete consciousness and power of motion. There is generally no recollection of what has passed. None of the secondary headache, lassitude, sickness, and loss of appetite are experienced, which so often follow the action of the cerebral stimulants.

Three stages more or less distinct may be observed in this action of chloroform; 1. a preliminary stage of slight cerebral confusion; 2. an anæsthetic condition, or insensibility to painful impressions, which comes on before consciousness and the power of motion are lost; and 3. deep sleep or coma, with complete muscular relaxation.

The insensibility may begin so early as fifteen seconds after the commencement of inhalation, and is very rarely postponed longer than two minutes. It continues from five to ten minutes; but may be kept up for several hours, by a careful repetition of the inhalation, at each period of commencing subsidence.

In some very rare instances, with more or less of the comatose condition, tonic spasms occur, or hysterical agitation, with screaming, laughter, &c., and now and then relaxation of the sphincters.

Poisonous Effects from Inhalation. When the effects of inhalation exceed those above mentioned, they may be considered poisonous, and death not unfrequently results. In this event, the respiration may become slower, the face and surface pale or livid, and the pulse more and more feeble, until respiration ceases, and the heart can no longer be felt to act. Under such circumstances, the fatal event is ascribable to an over dose of the poison, which, by completely paralyzing the respiratory nervous centre, suppresses the function of the lungs, and secondarily that of the heart. But there appears to be another mode of fatal termination, which occurs in general very speedily, and without warning, and often proceeds from very small quantities of the poison, much less than those frequently used with entire impunity. Thus, in at least two recorded instances, death has occurred from the inhalation of only thirty

drops. In these cases, it is apparently the heart which first ceases to act. It is asserted that this organ has been observed to become quite quiescent, while respiration still continued. In the first method of poisoning, the patient dies of asphyxia or apnœa, in the latter of syncope. In the one instance, death is the result of an excess of the ordinary action of the poison; in the other, of an extraordinary and apparently direct influence either on the heart itself, or on those nervous centres through which its functions are regulated. Against the latter result it does not seem that any care is sufficient to guard. The greatest precautions, both as to the size of the dose and its administration, have been taken without effect. The patient dies almost as if his heart had been paralyzed by a stroke of lightning.

The quantity of chloroform which has been employed in fatal cases has generally been one or two fluidrachms, though in some instances much larger, and in a few, as already mentioned, even smaller. The fatal result has repeatedly occurred in less than one minute from the beginning of inhalation, and has been postponed for an hour or more. In a table of 33 cases published in the *New York Journal of Medicine* (N. S. x. 400), 3 are stated to have died instantly, 2 in a minute, 10 in from two to ten minutes, 1 in a quarter of an hour, 1 in half an hour, 1 in three hours, and the remainder at indefinite or unknown periods, but most of them very soon, and some almost immediately.

Poisoning through the Stomach. The only case of fatal poisoning from the internal use of chloroform, which I have met with, is one reported in the *Ed. Monthly Journ. of Med. Sci.*, for Jan. 1852 (*page* 79). The patient, who was an inmate of an Infirmary, a man 27 years old, and partially intoxicated at the time, in a fit of despair, swallowed probably some ounces of chloroform, though the precise quantity could not be determined. He appears to have become insensible almost immediately, and in less than two hours was seen sound asleep and snoring upon the floor; but as he was supposed to be intoxicated, no further notice was taken until four hours afterwards, when he was first seen by a surgeon. He was then quite comatose, snoring loudly, with livid face and lips, dilated pupils which refused to contract with the light, complete insensibility to pain and all other impressions, a warm and moist skin, and a pulse 60, full, and soft. His breath smelt strongly of chloroform. The stomach was evacuated; but, after a short period of partial relief to the symptoms, he grew much worse, and appeared

to be dying, with interrupted respiration, cold and clammy skin, and slow and feeble pulse. Under oil of turpentine applied externally to his chest, and injected into the rectum, he revived greatly; but after some hours he again relapsed, and, about thirty-four hours after the poison had been taken, died suddenly, having been labouring for many hours under excessive vomiting, and violent dyspnœa. The lungs on examination were found so much congested that they did not collapse, the right side of the heart was distended with loose coagula, the left side empty and contracted, the brain and sinuses greatly congested, and abundant evidences of venous congestion were presented elsewhere. The patient evidently died of asphyxia, the joint result probably of the alcohol and chloroform, but ascribable chiefly to the latter. The main inference to be drawn from this case is that chloroform is much less powerfully and rapidly poisonous when swallowed, than when inhaled, and that little or no danger need be apprehended from its internal use in moderate doses.

Appearances after Death from Poisoning by Inhalation. The most prominent morbid appearance is venous congestion, which is generally very obvious in the lungs, and sometimes in a less degree in the brain; but, in the greater number of cases, the brain is healthy, and sometimes freer from blood than ordinarily in health. The heart is often, but not invariably, soft and flaccid. The blood is almost always fluid, and sometimes dark-coloured.

Treatment of Poisoning. If the poisoning has resulted from chloroform taken into the stomach, the obvious indications are to evacuate the stomach and bowels, and afterwards support the strength of the patient by external and internal stimulation; irritation of stomach, if it should follow the evacuation of the poison, being quieted by opiate enemata, and sinapisms or blisters to the epigastrium.

Poisoning by inhalation is unfortunately often so rapid that little time is offered for the intervention of remedies; and, when the poison attacks the heart especially, it is frequently rendered quite insensible to stimulant impressions. In most cases of apprehended asphyxia or syncope, it will be proper to try the effect of dashing cold water on the face and head; and a supply of fresh cool air should be kept up by fanning or otherwise. In order, moreover, to aid in rousing the sensibility of the nervous centres, spirit of ammonia, carbonate of ammonia, or other pungent volatile substance should be applied to the nostrils. Should the respiration have ceased, or seem about

to cease, it should be maintained artificially, either until there is no doubt of death having occurred, or until the patient is out of all danger from this cause. A tendency to syncope must be counteracted by laying the body in a horizontal position, with the head low. Should the pulse begin to fail, the countenance become pallid, or the surface cold, stimulation internally and externally should be resorted to. Ammonia and wine should be given by the mouth if the patient can swallow, oil of turpentine or other stimulants injected into the bowels, and active rubefacients with friction applied to the skin; and, under these circumstances of threatened syncope, I should not hesitate to have recourse to the respiration of the vapours of ether, as the most powerful restorative, and most likely to counteract the depressing effects of the chloroform. This remedy, however, would be less obviously proper, in cases of threatened asphyxia, with obvious venous congestion. Besides the measures mentioned, galvanism or electro-magnetism may be resorted to, in order to excite the lungs and heart; the current being so directed as to pass through the nerves supplying these organs, and the nervous centres in the medulla oblongata. If the positive pole be placed in the mouth or nostrils, and the negative applied over the diaphragm, as suggested by Dr. Herapath, the natural route of impressions from without upon the respiratory function, through the fifth pair of nerves, may be followed by the galvanic current. (*Lancet*, March, 1852, p. 303.) Or the diaphragm may be excited by direct irritation of the par vagum, as suggested by M. Duchenne (see *vol.* i. *p.* 547).

2. *Mode of Operation.*

Enough has been said already of the local action of chloroform. In relation to its operation on the system, few, I presume, doubt that it produces its effects through absorption into the blood. The odour of the breath of those who have taken it largely by the stomach, and the fact that it has been detected after death in the blood and different parts of the body, are sufficient proofs of the fact of absorption. It has been supposed by some that its primary influence is on the blood, which it is thought to change chemically, rendering it of a darker colour, and unfit for the support of the vital phenomena. But in opposition to this notion is the great rapidity with which its effects appear and disappear; and, besides, it is asserted, as the result of experiment, that it does not blacken, but on the contrary reddens the blood, when added to it out of the body. (See *Am. Journ. of Med. Sci.*, N. S., xxvi. 188.) When the blood is darkened, as it sometimes is under the poisonous action of

chloroform, the result must be ascribed to the want of change in the lungs, consequent on the defect of respiration. The blood in all probability merely serves as a vehicle for the medicine, by which it is brought into contact with the tissues upon which it operates. That the nervous centres are the parts primarily affected seems to me to be a necessary inference from the symptoms, which are at first exclusively nervous; for the excitement of the pulse, sometimes observed when it is administered by inhalation, is by no means constant, is at most very brief and fugitive, disappearing as soon as the true influence of the medicine is felt, and is in all probability quite as much the result of the agitations of the occasion as of the action of chloroform. It may possibly also proceed from the sympathy of the circulation with the primary excitant impression, made by its vapour on the fauces, and bronchial mucous membrane.

Admitting its primary operation on the nervous centres, we are next to examine which of them are affected. The loss of sensibility, the quick suspension of consciousness, and the relaxation of the voluntary muscles, point incontestably to the cerebral centres, those of sensation, intellect, emotion, and will—in other words the nervous centres of animal life, as the primary seat of impression. But, as sensibility to pain is abolished before consciousness, it follows that the centres of sensation are affected previously to those of thought and volition. Though the cerebral symptoms are certainly first observable, yet they are soon accompanied with those of respiratory and circulatory disorder, which increase as the first deepens; so that, when coma is fully established, the respiration has become slow and often stertorous, and the pulse also lowered in frequency and force, though in general not considerably so. It is evident that, by this time, the respiratory centre in the medulla oblongata is under the influence of the medicine; while the heart is probably depressed secondarily to the respiration. Lastly, under a longer continuance of the agent, the reflex centres in the spinal marrow, and possibly those of the ganglionic system suffer, and hence the occasional relaxation of the sphincters, the want of tonicity in the muscles, the flabby state of the heart, and the universal debility which supervene, with a still greater depression of the respiration and the pulse. Carried a little further, the medicine becomes a poison, and death from asphyxia takes place, with general venous congestion, but especially of the lungs.

Such appear to be the regular successive stages in the action of chloroform; but sometimes this regularity is interrupted; and the

influence of the poison extends to all the nervous centres conjointly, or to those of the heart more especially, including, perhaps, the ganglia in the cardiac tissue; and sudden and unexpected prostration comes on, with a pale cold skin, sunken features, and a vanishing pulse. It is in such cases that death ensues almost instantaneously; the heart ceasing to beat from the direct action of the poison, and the patient dying of syncope. They are the cases most to be dreaded, as least likely to yield to remedial measures.

But what is it that directs the action of the poison thus exceptionally upon the heart? It is not, as some have imagined, any previous disease of that organ, or general debility, or antecedent disease of any kind; for the result has occurred much more frequently in the absence of these circumstances, and in conditions of perfect health. Dr. Snow infers from his experiments on animals that, if the atmospheric air inhaled is loaded with as much as 8 or 10 per cent. of the vapour, the chloroform is apt to act directly on the heart, and thus becomes exceedingly dangerous; while, if it contain only from 4 to 6 per cent. it may be inhaled with impunity; as the poison, in this state of dilution, shows no disposition to affect the circulation directly, but expends its action on the brain, and may always be regulated. But they who examine carefully the published accounts of speedy death from chloroform, will find that this explanation of Dr. Snow will not hold good; for the quantity used has often been so small, and the caution exercised so great, that the degree of concentration of the vapour could not possibly have approached the point which he considers fatal. The only explanation we have to offer is, that individual idiosyncrasy sometimes causes excessive susceptibility in the nervous centres of circulation, so that they sink under an amount of influence which is generally quite harmless; just as we sometimes meet with individuals who will suffer excessive salivation from a grain of calomel. This is extremely unfortunate; as it takes away the opportunity of employing preventive measures; but an important practical inference is, that chloroform should never be tried, a second time, in persons who have on any occasion exhibited this idiosyncrasy, and happily escaped from its consequences with their lives.

One other question remains to be solved in relation to the method of operation of chloroform. Is it directly stimulant, as some have supposed, and indirectly sedative, or has it the property of immediately depressing the nervous centres on which it operates? This is a question of great practical importance, the decision of

which must frequently determine our course in relation to the use of chloroform. If we think it sedative, we should employ it under circumstances in which, as a stimulant, it would prove highly dangerous; and conversely, should avoid it when, in a similar supposition, it might be clearly indicated. The reader is already aware that I consider it directly sedative. Some reasons for thinking it so I have already given. The strongest are the symptoms of its action, which, so far as I have personally observed are always those of general depression. I have already referred, in this relation, to the symptoms produced by it when swallowed. Those resulting from its inhalation are not less conclusive. The medicine is inhaled; and almost instantaneously is seen a depression of the sensorial functions, without, for the most part, the least sign of preliminary excitement, such as opium, alcohol, and ether always afford. There is, it is true, not unfrequently an agreeable feeling of *bienaise* attending its first impression; but this is also an ordinary consequence of known depressing agencies, as of tobacco, the warm bath, and even bleeding. Often too the pulse and respiration are at first somewhat hurried; but they are more frequently directly reduced from the beginning; and, when the former condition takes place, it is so immediately after the commencement of operations, before the vapour can possibly have entered the system, that it may be justly ascribed, as before suggested, to the nervous agitation of the occasion, and might equally accrue, if atmospheric air were substituted for the chloroform. I do not, however, deny that chloroform may sometimes temporarily excite the circulation; but it is much more reasonable to ascribe the fugitive effect to the sympathetic extension, through the nerves, of the first irritant impression of the vapour, from the mucous surface to the cardiac and pulmonary functions, than to its direct influence on them. Finally, I do not admit the occasional examples of muscular spasms, laughter, turbulence, &c., as in any degree evidences of excitement of the cerebral centres; for similar conditions may result also from an immediately opposite condition; the cerebral functions having this seemingly remarkable singularity, that their irritation and depression are very often attended by the same phenomena, even to convulsions and delirium. The apparent symptoms of excitement, therefore, which occur in exceptional cases, having been explained in conformity with the essentially sedative influence of chloroform upon the nervous centres, we are permitted to allow full weight to those symptoms, much the most

frequent, which are obviously the result of depression. Post-mortem examination confirms this view. The brain is in the majority of instances found quite healthy, without congestion, showing that there has been no active irritation in the organ; and, when found congested, it has almost always been but moderately so, and not even in the degree which might have been anticipated, considering the frequency of death from asphyxia, which is characterized by venous congestion of the brain with the other great organs.

The reader must have been struck, in the preceding account of chloroform, with the remarkable difference, in the rapidity and degree of its action, as exhibited by the lungs and the stomach. In the latter, a much greater amount is required for a given effect, and this effect is much less quickly induced. I presume this difference arises from the two physical properties of great volatility and insolubility, the former giving it ready entrance into the system through the delicate pulmonary air-vesicles; the latter impeding greatly its absorption by the stomach. It is highly probable that, in the latter organ, the liquid chloroform, like the fixed oils, which it resembles in insolubility, is scarcely absorbed at all; and that it is through the vapour which must rise from it partially in the stomach, though necessarily with comparative slowness, that it finds entrance into the blood-vessels.

3. *Therapeutic Application.*

The first employment of chloroform medicinally was by the Drs. Ives of New Haven, who gave it, as prepared by Mr. Guthrie, so early as the year 1832, both by the stomach and lungs, in asthma, spasmodic cough, &c. In 1838, it was used by Dr. Formby, of Liverpool, in hysteria; in 1843, by Mr. Tuson, of London, as a local anodyne; and in 1844 by M. Guillot, of Paris, in asthma. In 1847, M. Flourens made experiments with it upon animals, proving its anæsthetic powers. But it was not until after the determination by Dr. Simpson, of Edinburgh, of its extraordinary efficiency in relieving pain, when inhaled in the state of vapour, and of its applicability for this purpose in the practice of surgery and obstetrics, that it came into general notice. At present there are few medicines more employed.

The *indications* for the use of chloroform, deducible from its known physiological effects, are 1. to relieve and prevent pain, 2. to relax spasm, 3. to promote sleep, and 4. to calm nervous irritations not falling into either of the preceding categories. *Contraindica-*

tions are, 1. debilitated and disorganized conditions of the brain, as in the advanced stages of meningitis, cerebritis, or apoplexy, typhous coma, atonic convulsions, &c.; 2. debilitated states of the heart, as dilatation with or without valvular disease, softening or fatty degeneration of the organ, and all instances of abnormally feeble action; 3. a constitutional tendency to syncope; and 4. considerable general debility from any cause. Besides, in cases of existing or threatened congestion in the lungs, brain, or indeed any of the great viscera, chloroform should never be pushed to the stage of coma, or that in which, through interference with the respiration, great venous congestion is induced; because the accumulation even of venous blood in these organs may prove highly dangerous, either by hemorrhage, by favouring the occurrence of low inflammation, or by immediately interfering with the function.

For the various purposes for which it is indicated, chloroform may be used by the stomach, by enema, by inhalation, or as an external application.

From its employment by *inhalation* many persons are deterred by the numerous instances of death, which have resulted from its use as an anæsthetic agent in surgery. The question of its appropriateness for this purpose I shall discuss hereafter. At present I wish to direct attention to its use in this way in medicine. The existence of violent nervous excitement in any form, whether in that of pain, spasm, or delirium, is well known to oppose considerable resistance to the influence of anodyne or narcotic agents. The remark applies in some degree to chloroform. Hence, the same danger of fatal depression from its use by inhalation is not to be apprehended, when it is opposed to an already existing pain, as when it may be employed in a healthy system, at least in one not thus protected, in order to prevent future pain; and it is a remarkable fact, that almost all the recorded cases of death from the inhalation of chloroform have occurred, either in persons who have used it with a suicidal intent, or in those to whom it has been given in anticipation of a surgical operation. Even, however, with this consideration in its favour, I would not recommend the inhalation of chloroform in trifling cases, where life is not involved, and when other unequivocal remedies are at command; but, whenever a violent and dangerous case may occur, in which the symptoms may indicate the use of this measure, it may be resorted to, I think, with perfect propriety; as the risk of fatal consequences, if due caution be observed, may be considered as almost infinitely small.

Internally by the *stomach*, for *injection into the rectum* in the form either of liquid or vapour, and for *external application*, it may be employed without apprehension of evil consequences, if we are to judge from all former experience.

Neuralgic Pain. As a means of relief in neuralgic pains, no remedy is more speedy, and none more efficacious for a time than chloroform. In most instances, however, it is merely palliative, having no control over the real pathological condition in which the pain originates; though sometimes, the pain being relieved, the morbid chain of association seems to be broken, and no return takes place, at least for a considerable time. It is, moreover, brief in its action, in proportion as it is rapid; and it is often necessary, in order to sustain the anodyne impression, to repeat the application at short intervals; so that the system loses through habit, in a considerable degree, the susceptibility to its influence, and it is necessary rapidly to increase the quantity to produce the same effect. It may, indeed, at length become, through repetition, altogether ineffective. Nevertheless, it is a most important addition to our anæsthetic means in the treatment of neuralgia; and the legitimate deduction from the facts just stated is, not that the remedy is to be neglected, but that it is to be used with due reserve, and in alternation or connexion with other measures, so that our resources may be husbanded. It is adapted to all forms of neuralgia, whether *idiopathic*, or *sympathetic* of other diseases, *rheumatic* or *gouty*, *internal* or *external*. Besides the ordinary forms of neuralgia affecting the enveloping tissues of the body, and the muscles, it is more or less useful in *angina pectoris*, *gastralgia*, *enteralgia*, *nephralgia*, *dysmenorrhœa or hysteralgia*, and in *spinal irritation*.

The most effective method of employing it in these affections is by inhalation; but this should not be resorted to except in cases of extreme violence, or attended with some danger unless relieved. It is applicable to the treatment of *angina pectoris*, which is usually a neuralgia of the heart, or possibly of the nervous centres supplying it with influence. By M. Carrière, who recommends it strongly in this affection, it is said to afford a sure means of cutting short the paroxysm.

It may be administered internally also in neuralgia, and good may be expected from it, thus given, in moderate cases of the disease, and especially when affecting the stomach, as in gastrodynia or gastralgia. Its tendency, however, when largely given in this

way, to irritate the stomach, and induce nausea and vomiting, is such, that its full anæsthetic effects cannot be conveniently obtained.

Topically employed, it often answers an admirable purpose; and, on the whole, this is the best method of applying it in neuralgia. Though known as locally anæsthetic to others, Dr. Isaac Hays, of Philadelphia, was, I believe, the first actually to employ it in this affection. The various methods of using it will be referred to under the head of the administration of the medicine. Among them may here be mentioned the introduction of its vapour into accessible passages, as into the vagina in *neuralgia of the uterus*, and into the *rectum* in the *same affection of that intestine*, or the neighbouring parts.

Painful Inflammatory and Carcinomatous Affections. There are many other painful local affections, besides neuralgia, in which the topical use of chloroform is often serviceable. Thus, it may be employed in inflammatory swellings, as *phlegmons*, *furuncles*, *paronychiæ*, *swelled testicle*, *inflamed glands*, &c.; in painful injuries, as *sprains*, *bruises*, *dislocations*, &c.; in *recent burns*, and irritating *cutaneous eruptions;* and in *carcinomatous tumours.* In *cancer of the uterus*, and other painful states of that organ, it has been used with alleviating effect by Dr. S. L. Hardy, of Dublin, in the form of injected vapour, which, though when first thrown up, it occasions a disagreeable sensation of heat, soon produces its legitimate anodyne effect. (*Dub. Quart. Journ. of Med. Sci.*, Nov. 1853, p. 306.) In the *tenesmus of dysentery*, the vapour has also been found useful by Ehrenreich, of Germany; the momentary irritation produced by it, being followed by relief, which, in one case, continued for three hours, with a suspension of the passages at the same time; and, after the subsidence of the immediate effect, the violence of the disease was found to be abated. (See *Ranking's Abstract*, xix. 89.)

Painful Spasmodic Affections. It is perhaps in these complaints, that chloroform displays its sedative powers to the greatest advantage. It is not only the anodyne, but also the relaxing influence of the medicine that is required; not only its operation upon the cerebral centres of sensation, but that also upon the centres of reflex action in the spinal marrow and sympathetic ganglia. It may with great propriety be employed by inhalation, whenever the violence of the affection may threaten life, and resist ordinary measures. There may, too, be cases in which the promptness of its effects may be of great importance. *Spasm of the stomach*, the *more obstinate forms of colic*, *spasm of the uterus*, *bladder*, *and urethra*, *spasm of the biliary ducts*, *strangulated hernia*, *the violent pains and cramps of cho-*

lera, *tetanus*, and *the poisonous effects of nux vomica*, are the particular diseases in which the remedy has been recommended. Little can be expected from chloroform in these affections, either given by the stomach, or locally employed. Perhaps, in the spasms of the urinary organs, the injection of the vapour into the rectum might prove useful; and the application of the liquid to the perineum might aid in relaxing spasm of the urethra. M. Aran has used it successfully in lead colic, administered by the mouth and rectum, and applied to the abdomen. (*U. S. Dispensatory*, 10th ed., p. 846.) But a more powerful impression is generally required than can be obtained from these modes of employing the remedy; and it is from inhalation alone that much good can be expected. In *tetanus* the measure has been frequently resorted to, generally with the effect of alleviating the sufferings of the patient, and in some few cases of aiding in the cure. Too frequently, even after relief has been obtained from suffering, the patient has sunk into a prostrate condition which has proved fatal. Debility is one of the great dangers of tetanus, and, in the choice of anæsthetic agents, prudence would, I think, point to the stimulating rather than to the sedative. Opium and the alcoholic remedies have generally proved among the most efficient means of cure. If the anæsthetic influence of inhalation is wanted in addition, I should on this ground prefer ether to chloroform; or, if the more powerful agency of the latter were required, I would combine the two, so that the direct sedative action of the one might be counteracted by the stimulant action of the other. The same remark is applicable to the treatment of poisoning by nux vomica, which is essentially a tetanic condition.

Convulsive and Spasmodic Affections without Pain. Many of these are very advantageously treated with chloroform. In *hysteria* it has been considerably used, and in the convulsive forms of the disease, when peculiarly violent, may be inhaled with benefit. Its topical use may also be resorted to in some of the spasmodic phenomena of the affection, as spasm of the rima glottidis, œsophagus, or neck of the bladder; though on the whole it cannot be ranked among the most efficient remedies in this complaint. Even less can be said of its usefulness in *epilepsy*, in which it has been tried with little advantage, whether in relieving the paroxysms, or preventing them. Indeed, it has been accused of bringing on the convulsions when employed in the interval. In *eclampsia*, however, it has proved highly serviceable, and is probably, after due depletion, among the most effective remedies. *Puerperal convulsions* appear

to have been greatly benefited by it, and in the *infantile affection* it may be resorted to, when other measures fail. As active congestion of the brain is an ordinary condition in these convulsions, chloroform is probably a safer remedy than ether, which might, by its stimulant powers, aggravate the congestion into inflammation. *Hooping-cough* is usually too mild a complaint to justify a resort to this heroic remedy, in its most efficient form, unless under rare circumstances of extreme violence. As an addition, however, to cough mixtures, internally exhibited, it may be used to allay the cough, for which purpose, though less efficient than opium, it has the advantage of not checking bronchial secretion. Inhaled in the paroxysms of *spasmodic asthma*, it is asserted to have proved very efficient; and in numerous instances has given prompt relief. It should, however, in this and all other pulmonary affections, be restrained within the comatose point; as it might otherwise endanger serious congestion of the organ. In *laryngismus stridulus* it has been highly recommended; and might be cautiously employed in obstinate cases of *catarrhal* or *spasmodic croup*. *Obstinate hiccough* will often yield to its internal use, especially if given with camphor in emulsion.

Wakefulness. To promote sleep, chloroform has been used with advantage in *delirium tremens*, the violent paroxysms of *chronic insanity*, and in the extreme restlessness and delirium of the low forms of fever. In the two former affections, it has been used by inhalation; in the febrile disorder, only by the mouth, twenty or thirty drops being given every hour. I confess that I should have some apprehensions of its sedative effect in simple delirium tremens, which is essentially a disease of debility, and in which, according to my own observation, the greatest danger arises from prostration. It should never, I think, be administered in that affection unless in connexion with one of the cerebral stimulants, as alcohol or ether, while opium is at the same time given by the mouth.

Inflammations. Chloroform has been less used in inflammatory complaints than its sedative powers would seem to justify, if not to demand. But, unless in exceptional instances, or when the vapours are largely inhaled, the influence of the remedy is comparatively little felt by the circulation; and there are other sedatives which are much more to be relied on. Nevertheless it has been recommended in *pneumonia* and in *cerebro-spinal meningitis*. In the former complaint it has been used by Varentrapp, of Frankfort, Germany,

with extraordinary success. He employed 60 drops of it, placed on cotton so that the vapours might be inhaled for ten or fifteen minutes, and repeated the dose every two, three, or four hours; taking care that it should not produce unconsciousness. (See *Am. Journ. of Med. Sci.*, N. S., xxiii. 517.) MM. Trousseau and Pidoux speak of the advantageous use of anæsthetic inhalations by M. Besseron, in an epidemic of cerebro-spinal meningitis, occurring at Algiers; but do not state whether the agent employed was ether or chloroform. Of fourteen cases, six were cured, and the remainder suffered no aggravation from the treatment. (*Trait. de Thérap.*, ii. 190.)

Various Affections. For the alleviation of *cough* in ordinary catarrh, phthisis, and other pectoral complaints, chloroform has been used internally with advantage in connexion with expectorants, and may be substituted for opium when this may be contraindicated. It has been used also, in the same way, with success, in the relief of the epigastric uneasiness and general depression of spirits attendant on *hypochondriasis.* As an antiperiodic it has been proposed in *intermittent fever.* It has been recommended also as an injection in *gonorrhœa;* but, if employed for this purpose, it should be largely diluted with some bland fixed oil.

4. *As an Anæsthetic Agent, for the Prevention of Pain.*

1. *As an Anæsthetic in Surgery.* To prevent pain in surgical operations, chloroform is now employed to a vast extent throughout Europe, where it is preferred for this purpose to ether, notwithstanding the numerous deaths which have been reported, and those probably not less numerous which have not found their way into the journals. Though used also to some extent in this country, I believe that American surgeons generally prefer ether, on account of its greater safety. Undoubtedly, chloroform has many advantages over the latter agent. The quantity of it required is much less; it operates more quickly, and thus saves time; it is much more agreeable in odour and taste than ether; on this account, as also on account of its less tendency to irritate the throat and lungs, it is much more conveniently and comfortably administered; it produces no violent intoxication or delirium, and gives rise to none of those turbulent movements which often embarrass the operator who prefers the rival anæsthetic; finally, its after consequences are less unpleasant, and, if the patient escapes its immediate prostrating effect, he will not be liable to subsequent injury, which cannot always be said of the use of ether. There can be no doubt that, in

point of convenience, of efficiency, and of comfort both to the operator and the patient, chloroform has greatly the advantage. The only point of inferiority is its greater danger. While not one well authenticated case of immediate death from ether, used as an anæsthetic agent in surgery, can be adduced, and very few even of remoter evil consequences; the recorded list of fatal results ascribed to chloroform has swelled nearly or quite to sixty. It is true that even this large number sinks to seeming insignificance when compared with the tens of thousands, I might probably with truth say the hundreds of thousands of cases, in which chloroform has been employed with safety; and, were there no other anæsthetic agent than this, the various advantages accruing from the annihilation of pain in surgery, and probably among them a much larger average number of successful operations, and the consequent great saving of human life, would far overbalance the evil of the occasional fatality. But the question is altered when a substance is at hand, having all the essential properties for securing the same end, almost without danger to life. Is not the real controversy between convenience with the risk of life on the one hand, and discomfort with comparative safety on the other? Has the surgeon the right to sacrifice one in a thousand or in ten thousand lives, for his own convenience, and that of the greater number who escape? It seems to me that but one answer can be given to this question. The only counterbalancing consideration in favour of chloroform is that, by the comparative quietness of the patient, the surgeon has a better command of success, and that lives may possibly be saved in this way sufficient to outweigh the direct fatality. This may possibly be so; but until the fact is pretty satisfactorily ascertained, I think the American surgeons stand upon somewhat firmer ground of morality than their transatlantic brethren.

2. *As an Anæsthetic in Midwifery.* For the application of the inhalation of chloroform to the relief of pain in delivery, the world is indebted to Professor Simpson, of Edinburgh. It has been satisfactorily ascertained that, under the influence of this agent, the pain, ordinarily attendant upon the uterine contractions in childbed, may be entirely annihilated, without in general interfering in the least degree with the efficiency of the contractions themselves, whether in relation to frequency or force. This relief, moreover, may be obtained without carrying the inhalation so far as to suspend consciousness. Another important fact, in connexion with this application of chloroform, is that it has a tendency to produce relaxation

of the os uteri and of the passages, and thus to facilitate delivery when impeded by rigidity of these parts. Sometimes, when the inhalation is urged to the point of producing coma, and bringing the organic nervous centres under its influence, the contractions are suspended; and Dr. Robert Lee has related five cases, in which it was necessary to have recourse to the forceps under such circumstances; but, on the other hand, it is asserted by Drs. Simpson, Murphy, and others, that, in their experience, the contractions uniformly return on the omission of the chloroform; and Dr. Murphy seems to think that, in the cases mentioned by Dr. Lee, the contractions may have ceased independently of the chloroform, as they do when it is not used, or the inhalation may have been improperly persevered in, after signs of relaxation had presented themselves. (*Brit. and For. Med.-Chir. Rev.*, April, 1855, Am. ed., p. 275.) In addition to these grounds of judgment, as to the propriety of using this anæsthetic in midwifery, the fact may be mentioned that, notwithstanding the vast extent to which the agent has been for some years employed, the occurrence of death under these circumstances is extremely rare. I have met with the accounts of only three cases, in which there was any real ground for suspicion that death resulted from the chloroform. One occurred from the use of it by a nurse, in a case of natural labour, without the presence of a medical man, and is, therefore, to be counted for nothing more than that the medicine is capable of poisoning. The second is one related by Dr. Ramsbotham, in which, at the end of an hour and a half after the chloroform had been suspended, without any loss of consciousness in the mean time, distressing dyspnœa came on, followed by convulsions and speedy death. It seems to me quite impossible, judging from what is known of the method of operating of chloroform, that it should have been the cause of the fatal issue in this case. Death often occurs from puerperal convulsions, without chloroform, and probably more frequently without than with it. (*Ibid.*, p. 277.) A third case is related, in the *Buffalo Medical Journal*, for December, 1853, by Dr. De Wolf, of Chester, Massachusetts, in which death is said to have occurred; in which also there was the suspicious circumstance, that the patient did not lose her consciousness. (*N. Y. Med. Times*, May, 1854, p. 300.) Various other objections have been urged against this use of chloroform. Thus, insanity, epilepsy, peritonitis, phlebitis, and various cerebral disorders following the use of chloroform, have been ascribed to it as effects; but, as seems to me, with as little justice as if all the various disorders occurring

after delivery, puerperal convulsions, puerperal fever, and puerperal insanity among them, should be attributed to a dose of opium given in the course of the process. No perceptible effect is produced by the use of chloroform on the fœtus.

How far the anæsthetic practice may be desirable or justifiable in childbed, and, if employed at all, under what peculiar circumstances it is most appropriate, are questions which belong to the obstetrician to solve. My object has been to show chloroform as it really is, divested of all its imaginary terrors; so that the practitioner may not be deterred from using it by any unfounded fears, if he believe it to be indicated. That the same superiority of ether over it, which may be claimed in surgical practice, does not exist in the obstetrical, follows, I think, from the facts above stated. That it is less fatal in midwifery than surgery is owing, in all probability, to the circumstance that, in the former, it is given to relieve pain, in the latter, to prevent it; pain having apparently the effect of resisting, to a considerable extent, the depressing influence of chloroform on the organic functions. One rule is now, I believe, generally acknowledged by those who advocate the use of this anæsthetic in midwifery; that it should never be purposely pushed further than is necessary for the relief of pain, nor carried so far as entirely to abolish consciousness. The greatest caution, moreover, and watchfulness should be exercised in its use, so that, upon the least sign of over-action, it should be withdrawn; and its administration should never be entrusted to unskilful hands. Another caution, if observed, would probably go far to insure its safety; to combine it, namely, with an equal or larger proportion of ether, so that the stimulant influence of the latter agent may counteract its sedative effect on the heart.

5. *Administration.*

Chloroform is administered by the stomach, by the rectum, by inhalation into the lungs, and topically, either in the liquid form or that of vapour.

The dose for internal use may be stated at from ten to twenty minims, equivalent, on the average, to from forty to eighty drops, which may be repeated every half hour, hour, or two hours, and gradually increased, if necessary, until the desired effect is obtained, or either nausea, or some other unpleasant symptom is produced. In consequence of the weight and insolubility of the liquid, it must be given in emulsion; and this is best made by rubbing the chloroform

first with a little almond or olive oil, and then incorporating this mixture with water, by the intervention of mucilage of gum arabic and sugar, or syrup, in the ordinary form. Dr. Hartshorne recommends it to be suspended in water by means of the syrup of orgeat. I have found it to mix well with water by means of the yolk of an egg, of which one may be employed to four or six fluidounces of the vehicle. A tablespoonful of the mixture should contain the intended dose of the medicine. When camphor is simultaneously indicated, an elegant mixture may be made by dissolving the camphor in the chloroform, and suspending the solution in water by the yolk of an egg as above.

An alcoholic solution of chloroform has been kept in the shops, and sold under the altogether inappropriate name of *chloric ether*. The preparation should, I think, be abandoned for internal use. The chloroform contained in it is in small proportion, varying from 5 to 18 per cent., and, if in larger proportion than 10 per cent., is apt to be separated on dilution with water; and, altogether, it is rather the alcohol than the chloroform which acts.

By *enema*, from half a fluidrachm to a fluidrachm may be administered, which, in order to obviate irritation, should be made into an emulsion, as above recommended.

For *inhalation*, the full dose usually employed is a fluidrachm, which may be repeated in two minutes if no effect is produced. When peculiar caution is deemed requisite, half the quantity may be used at first; and it has even been recommended, under such circumstances, to administer not more than ten minims at once, to be repeated from minute to minute till it acts. It has sometimes appeared to operate with an accumulated influence; several portions having been given successively without effect, and at length, after an additional one, alarming and even fatal effects suddenly coming on, as if from the conjoined action of all the doses used. It would be most prudent, therefore, in resisting cases, not to proceed regularly onward, for an indefinite length of time, till the medicine may act; but, after a quantity has been administered sufficient, under ordinary circumstances, for a powerful impression, to allow several minutes to intervene before the medicine is reapplied. When it is desirable to maintain a given impression long, the inhalation may be cautiously resumed upon a subsidence of the symptoms; and it is astonishing what quantities are thus borne with impunity, considering the well-known power of the medicine. Professor Simpson has used eight fluidounces in thirteen hours, in a case of labour; and thirty-six ounces are said to have been administered

in one case, in the course of two weeks, without unpleasant effects. (Dr. W. H. Byford, *Am. Journ. of Med. Sci.*, xxiii. 279.)

Various methods of administration have been recommended, and numerous instruments invented for facilitating inhalation. That of Dr. Snow, of London, probably conjoins safety and convenience as effectually as any other, and is most used in England. The great principles which should govern the process are, that sufficient atmospheric air must be admitted to support respiration; and that the vapour inhaled should not be so concentrated, as to endanger the entrance of too large a proportion at once into the blood. Probably, on the whole, for those not particularly conversant with the use of an instrument, it would be advisable to follow the method originally, and, I believe, still employed by Dr. Simpson, or that used for the administration of ether by the Boston surgeons, who were the first to carry etherization into effect. The first is to twist a common handkerchief into the form of a bird's nest, and to apply this, wet with the chloroform, near the nose and mouth of the patient, taking care not to interfere in the least with the entrance of the atmospheric air; the second is to use, in the same way, a piece of sponge hollowed out on one side, and with holes through it to admit the air. Dr. Warren recommends a small towel, folded in the shape of a funnel in order to protect the face, and the anæsthetic fluid to be poured, either upon a sponge double the size of an egg placed in the apex of the funnel, or upon the inner surface of the towel itself.

Experience has suggested various cautions in conducting the process. In the *first place*, it is advisable, for all medical and obstetrical purposes, to stop short of the abolition of consciousness; and, even in surgery, profound coma should be avoided. *Secondly*, particular watchfulness should be directed by a competent person to the state of the symptoms, so that, upon the instant that slow or stertorous respiration is produced, or the pulse begins to fail, the chloroform may be withdrawn. *Thirdly*, restorative measures should be immediately resorted to, if called for by alarming symptoms; and for this purpose the requisite means should be provided before hand. Life has, no doubt, often been saved by this precaution. (See *page* 195.) *Fourthly*, it is generally thought advisable not to administer chloroform on a full stomach, or in cases of disease in which the heart is debilitated, whether functionally or organically, or in any case in which there is a disposition to syncope.

It is probable that *combination with ether* would serve as the best protection against the debilitating influence of chloroform upon the heart. The two medicines co-operate in the production of the anæsthetic state; while, as hereafter stated, theory at least would indicate that the depressing effects of the chloroform would be counteracted by the stimulation of the ether. This plan has been extensively adopted in the United States. Equal measures of the two liquids may be used, although I should prefer one measure of chloroform to two of ether. It is, of course, only as an anæsthetic agent that this combination has been recommended. When the object, as in many cases of disease, is to obtain the sedative effects of the chloroform, and there may be a contraindication of ether on account of its stimulant properties, the former medicine should be given unmixed.

The late Dr. John C. Warren, of Boston, was in the habit of using a *mixture of chloroform and pure alcohol*, in the proportion of one part of the former to two of the latter, under the impression that the narcotic power of the chloroform thus diluted might be less dangerously exercised. He originally used the impure product, obtained by the first distillation from the materials employed for preparing chloroform, called improperly *chloric ether;* but substituted the above preparation, as more definite in composition, and called it *strong chloric ether*. It is simply chloroform diluted with alcohol, and is probably safer, in surgical practice, than chloroform alone, both from the diluted state in which the vapour enters the lungs, and the counteragency of the stimulating vapour of alcohol. Dr. Warren employed it frequently, and in no case with evil results. (*Effects of Chloroform*, &c., Boston, 1849.)

The *topical application* of chloroform is made in various ways. The simplest is to saturate with it a piece of soft linen, and, having placed this upon the surface, to cover it with oiled silk, in order to prevent evaporation. This, however, in general occasions at first a very disagreeable burning pain, with rubefaction, which, though often in itself useful, renders the method objectionable in many instances, particularly in persons of very sensitive skins. Another method, which I have frequently used, is to mix it with an *emollient poultice*, as of bread and milk for example. Or it may be made into the form of a *liniment* or *ointment* by admixture with olive oil or lard, in the proportion of one part of the chloroform to two or more of the oleaginous matter, and applied by inunction. It may be used, too, as a *lotion*, simply diluted with alcohol, or added

to the camphorated tincture of soap. It was at one time thought that its local anæsthetic property might be taken advantage of to prevent the pain of surgical operations; but the influence does not extend to a sufficient depth. In superficial operations, however, such as the opening of boils and abscesses, and incisions in cases of anthrax, &c., it may sometimes prove serviceable.

Another mode of *topical application* has recently been proposed, and promises to be advantageous under various circumstances. It was suggested by Dr. S. L. Hardy, of Dublin, in a communication to the *Dublin Quarterly Journal of Medical Science* (Nov., 1853, p. 306), detailing several cases in which the vapour was beneficially applied to the uterus, in painful affections of that organ. Dr. Hardy employs for the purpose a gum-elastic bottle, to the mouth of which is attached a small metallic chamber, having at its other extremity a pipe furnished with a valve. At the same end with the pipe, is a valve to admit atmospheric air for the working of the instrument, and, on the side of the chamber, a stoppered opening for the introduction of the chloroform, which should be wholly absorbed by a piece of sponge contained in the chamber. The vapour is expelled by pressing the bottle. Any one can contrive a substitute for this instrument, who may possess an ordinary air-tight injecting syringe. The vapour may be directed from the mouth of the instrument, in a jet, upon any external part, or may be carried to any position where it may be required by means of a tube. It may be injected into the vagina, rectum, urethra, external auditory meatus, or morbid cavities. To the surface of the body, the vapour may also be applied by inverting over the part a hollow vessel, a tumbler for example, in which a sponge saturated with the liquid has been placed, sufficiently large to fill the bottom of the vessel, so that it may not touch the skin. The vapour produces the anæsthetic effect with only a preliminary sensation of warmth, which is scarcely inconvenient. Since the publication of his first communication, Dr. Hardy has very much extended this method of using chloroform. He has found it extremely useful in quieting the *nausea* of choleric diarrhœa when applied to the epigastrium; and enumerates among the affections in which it had proved useful, gout, rheumatic gout, anthrax, a painful stump after amputation, painful hemorrhoids, irritable bladder in which the vapour was introduced into that viscus by means of a catheter, painful menstruation, ulcerated os uteri, and carcinoma of the rectum. The catalogue might, no doubt, be greatly extended. (See *Ranking's Abstract*, No. 21, p. 120.)

III. HEMLOCK.

CONIUM. *Lond., Ed., Dub.*

Hemlock is the product of *Conium maculatum*, an umbelliferous, herbaceous, biennial plant, indigenous in Europe and Asia, and naturalized in the United States, in some parts of which it grows in considerable abundance. One of the most remarkable characters of the plant, from which it acquired its specific name of *maculatum*, is the appearance of the stem, covered with purple spots. The whole plant exhales a fetid odour, compared to the smell of mice, especially in its flowering period in July and August. It is said to be most energetic as a medicine, in hot dry seasons, in sunny situations, and in warm climates. Though poisonous to man, it is eaten with impunity by horses, goats, and sheep. Two parts of it are officinally recognized; the leaves, namely, and the fruit.

The student should guard against the use of the name *cicuta*, which, after the Roman authors, has frequently been applied to this plant; and continues to be applied by many. Botanists having given the Greek name κώνειον to the genus to which it belongs, and the Latin name *cicuta* to a wholly different genus; and, the former having been adopted in the officinal codes as the title of the medicine, it becomes the profession to abandon the latter altogether, in order to avoid confusion. This is the more important in the U. States, as we have an indigenous poisonous plant, which has received the name of *Cicuta maculata*, or *American hemlock*, and might, without some caution, be confounded with the genuine hemlock of the old continent. The *Cicuta maculata* has a purple stem, less spotted than the conium, and grows in low meadowy or swampy grounds, while the latter flourishes on the upland. Several cases of poisoning have occurred among children, from eating by mistake the root of American hemlock.

1. Hemlock Leaves.— *Conii Folia.* U. S.

These are bipinnate or tripinnate, with channelled footstalks, and small, incised leaflets, which are deep-green above, and paler beneath. When gathered, if intended for keeping, they should be deprived of the footstalk, and dried at a temperature not exceeding 120° F. They may be kept whole or in powder, and should be excluded from the air and light, as they rapidly deteriorate on ex-

posure. With the greatest care, they undergo a gradual deterioration, and should not be used when more than a year old.

The dried leaves, when in powder, have a fine deep green colour, and a strong, peculiar, but not disagreeable odour, which differs from that of the growing plant, and is probably unconnected with their medicinal efficiency. Their taste is bitterish and nauseous. Water distilled from them has their odour, but not their narcotic properties. If good, they emit the odour of mice when rubbed with solution of potassa.

2. HEMLOCK SEEDS.— *Conii Semen.* U. S.

The fruit of the hemlock plant, commonly called seeds, is roundish-ovate, about one-eighth of an inch long by one-twelfth broad, and composed of two plano-convex parts, easily separable, and each of them with five crenated or notched ribs, running from end to end on the convex surface. They have a yellowish-gray colour, a feeble odour, and a bitterish taste. They are stronger than the leaves and keep better; and, after attaining their full size, are more powerful green than dried.

Both the leaves and seeds yield their virtues to water, alcohol, and ether; but long boiling with water renders them inert. On destructive distillation, they yield a poisonous empyreumatic oil.

Active Principles of Hemlock. Hemlock yields a volatile oil upon distillation with water, which appears to be destitute of poisonous properties. The principle upon which its activity mainly, if not exclusively, depends is a peculiar volatile alkaloid called *conia* (also *conicin* or *conein*), which, as it exists in the plant, is combined with an acid, probably the *coneic*, by which it becomes fixed, so that it is not given over with water in distillation. As conia has been introduced into use as a medicine, it will be described among the preparations of hemlock. It was first obtained, in an uncombined state, by Geiger.

Effects of Hemlock on the System. Hemlock has little local irritant effect; appearing to operate as a direct sedative to the sensibility of the part with which it is brought into contact. In its influence on the system, it is sedative to the nervous centres, especially those of the brain, and indirectly depresses the circulation, but has comparatively little effect on this function. It rarely purges or vomits; and, though said to be sometimes diaphoretic or diuretic, does not generally produce these effects, and cannot be depended on for them.

In doses insufficient to produce any very obvious physiological effect, it appears not unfrequently to exert a soothing or composing influence over nervous disorder, and has been thought by many to possess very valuable deobstruent and alterative properties. By the ancients it was supposed to have a tendency to produce atrophy of the mammæ and testicles, and to restrain the secretion of milk; and these opinions are not without support from modern writers.

In doses sufficiently large to produce an obvious impression, but still within medicinal limits, it may occasion warmth in the stomach, a sense as of fulness of head, giddiness, headache, dimness of vision, a feeling of weariness in the limbs and of general muscular weakness, faintness, perhaps nausea, without the slightest sign of exhilaration, or elevation of mental function of any kind. The pulse is usually little affected, certainly not increased, but sometimes depressed when the influence is somewhat powerful. In careful experiments, conducted on himself by Dr. Pliny Earle, at the time physician of the Bloomingdale Asylum for the Insane, New York, the most prominent symptoms were, first warmth in the stomach, and soon afterwards headache or a feeling of cerebral oppression, slight vertigo, and a sense of weariness or weakness about the knees and elbows, with a want of firmness in the gait. The pulse was but slightly affected; and no drowsiness, or increase of the secretions appears to have been produced. He employed doses of the extract, gradually increased from one to one hundred grains. The effects of the medicine on the head began to be felt in 15 or 20 minutes, were at the height in 35 minutes, and had entirely disappeared in an hour and a half. (*Am. Journ. of Med. Sci.*, N. S., x. 61.)

Poisonous Effects. Very different accounts have been given of the poisonous operation of hemlock, and apparently upon equal authority. The effects usually observed have been disorder of vision, dilated pupil, difficulty of speech, tremors, paralysis, delirium or stupor, and finally coma, convulsions, and death. In cases quoted by Orfila, delirium and stupor were the prominent symptoms; while, in a well-authenticated instance reported by Dr. J. H. Bennett, of Edinburgh, there was no stupor until shortly before death. The effects, in Dr. Bennett's case, were successively a staggering gait as if from intoxication, complete paralysis of the upper and lower extremities, and loss of vision and of speech, with only slight occasional twitchings of one of the legs. The palsy of the limbs was complete two hours after the poison was taken, and

death occurred in three hours and a quarter. (*Ed. Med. and Surg. Journ.*, July, 1845.) That a paralyzing influence over the voluntary muscles, and ultimately over the respiratory system, with death from asphyxia, are the ordinary effects of poisonous doses of conium, are also inferrible from the experiments of Dr. Christison on the lower animals, both with the extract of conium, and the active principle conia. He observed paralysis of the voluntary muscles with occasional slight convulsions, then paralysis of the respiratory muscles, and finally death from asphyxia, the heart continuing to contract long after respiration had ceased. Sensation did not seem to have been impaired. Opposed to these results, however, are the observations of Mr. Judd, who, in experiments on cats, found that even doses not large enough to be poisonous caused great languor and drowsiness, and often profound sleep for two or three hours; the muscular excitability being lessened, and the circulation and general temperature reduced.

The *appearances observed after death* have been general venous congestion, a dark and fluid state of the blood, and a softened condition of the brain.

The remedies for poisoning are to evacuate the stomach, and subsequently to support the strength by stimulants; artificial respiration being resorted to, should the breathing have ceased. A case is recorded by Dr. Alderson, in which general paralysis was induced by an over-dose, with relaxation of the sphincters, which continued for nearly an hour, and gradually gave way under stimulation; the patient remaining the whole time perfectly sensible. (Alderson, quoted by Pereira, *Mat. Med.*, 3d ed., p. 1728.)

Mode of Operation. That hemlock is slightly irritant locally is inferrible from the warmth of stomach mentioned by Dr. Earle as produced by it when swallowed, and from the acrid properties of its active principle. There is every reason to believe that it operates on the system, through the absorption of its active principle; as its peculiar effects are produced by conia, to whatever part having the absorbing power it may be applied, and with a rapidity proportionate to the degree of that power in the part. Besides, though Dr. Christison could not detect it in the blood, it was discovered there by Mr. Judd, in animals which had been poisoned with it. (*Christison's Dispensatory*, Am. ed., p. 411.)

I have before stated my belief, that the action of hemlock is directly sedative to the nervous centres, and especially those of the

brain. Dr. Christison infers, from the occurrence of paralysis of the voluntary muscles, that it operates primarily on the spinal marrow. But it is not the spinal marrow that governs the voluntary movements. Its centres are those of reflex action, and not those of volition. It is true that organic injury or disease of the cord produces palsy of the voluntary muscles; but this is by interrupting their communication with the brain by disease of the connecting fibrils, not through disease of the centres. Now it is not probable that conium operates by incapacitating the fibrils for the performance of their conducting function. By paralyzing merely the spinal centres, it could only paralyze their reflex function. The loss of power, therefore, in the voluntary muscles appears to me to result from an impression upon the cerebral centres; upon those, namely, through which the will operates; as the same effect follows apoplectic effusion. A proof that it is the cerebral centres upon which the poison acts is, that the other phenomena are mainly cerebral, such as vertigo, dimness or loss of vision, headache, &c., not to speak of the delirium and stupor which are asserted by many, and have generally been believed to be produced by the poisonous action of hemlock. That these latter phenomena should have been observed in some instances only, is no proof that those persons have been mistaken who have noticed and recorded them. It is not impossible that the influence of the poison may, on one occasion, be exerted specially on the proper sensorial centres, and, on another, upon those of voluntary motion; and that, in other instances, again, it may affect both. Chloroform exhibits the same diversity, being directed sometimes with peculiar energy to the sensorial centres, and at others to the centres which govern the actions of the heart. On the whole, therefore, I think we are safe in considering conium as a cerebral sedative, extending its influence, in fatal cases, to the respiratory centres, and causing death by asphyxia.

Therapeutic Application. Though known and employed by the ancients both as a poison and medicine, and famous as one of the instruments used by the Athenians for the execution of those condemned to death, it seems to have been wholly neglected for many centuries, and did not again come into notice till brought forward with so many other narcotics by Baron Störck.

The indications which it is calculated to fulfil are, to relieve pain, relax spasm, and compose nervous irritation in general. It has been supposed to induce sleep; but, in those cases in which it has seemed to produce this effect, it probably operated by merely con-

trolling the nervous disturbances which prevented sleep. Not a few, also, from the time of Störck down to the present, have been disposed to ascribe to it extraordinary deobstruent and alterative properties, rendering it useful in a great number of diseases.

1. To *relieve pain*, it is habitually used by many in *neuralgic affections*, either alone or combined with other narcotic extracts, as those of belladonna, stramonium, and hyoscyamus. Though not a very powerful agent in these cases, I believe that it often does good, and serves an excellent purpose as an adjuvant to other measures.

In *nervous and chronic rheumatism*, it may be employed with advantage for the same purpose, especially in connexion with alteratives adapted to this affection.

In *carcinomatous tumours* and *sores*, and in various other painful swellings and ulcerations, as the *scrofulous* and *syphilitic*, for example, it has been found useful by relieving pain, and quieting nervous irritations, and has been considerably used as an adjuvant. In these complaints, it has been employed both internally and topically.

2. With a view to its *antispasmodic effect*, it has been given in *hooping-cough* and other *spasmodic coughs*, and in *asthma;* and may be added to other medicines in the more severe affections of this kind, as *epilepsy*, *chorea*, &c., in which, however, little efficiency must be expected from it.

3. To relieve *irritation*, it may be substituted for opium when that narcotic is forbidden, in all kinds of *cough*, including that of *chronic catarrh* and *phthisis*. It may not only be used internally in these affections; but may also be administered by inhalation. Sir C. Scudamore recommended the tincture of conium, in connexion with iodine, for inhalation in phthisis. As conia, in the form in which it exists in the leaves, does not rise with boiling water, it cannot be that principle which acts in this case; but by adding a little aqua potassæ or other alkali to the conium, the volatile alkaloid may be extricated, and thus received into the lungs. But the first trials with the remedy in this form should be conducted with caution. In the treatment of coughs, it should generally be given with expectorants, as tartar-emetic, ipecacuanha, squills, and senega.

Insanity is supposed to be occasionally much benefited by conium, which has been very extensively used in that complaint. It probably operates by composing nervous disquietude, and thus enabling the patient to sleep. If it be, as I deem it, a cerebral sedative, it is very well calculated to meet a prominent indication in the

disease, namely, to keep down nervous excitement, without inducing debility.

4. As a *deobstruent* and *alterative*, hemlock has been very largely used. It was mainly in reference to its supposed power of curing *cancer* and similar affections, that it was reintroduced into practice by Störck. That it has any power of this kind few now believe; nevertheless, it is thought by many to prove highly advantageous, in some instances, not only as a general and local anodyne, but also by favourably modifying the condition of the tumours or ulcers, and retarding their progress. This influence we may ascribe to the medicine as the result of its sedative properties, through which it may diminish irritation and inflammation, to which these heterologous formations are incident like other structures. In other less obstinate *tumefactions* or *ulcerations*, as the *scrofulous*, *rheumatic*, and *syphilitic*, it has seemed occasionally to produce cures, or at least to aid more efficient alteratives in producing them. In reference to the same supposed deobstruent property, it has been used in *goitre*, enlargements of the *liver*, *spleen*, and *pancreas*, in *chronic abdominal tumours*, and especially in *tumefactions of the mammæ and the testicles*, over which it has been supposed to exercise peculiar power. In these complaints, it is used both internally and topically. We may admit its partial efficacy in all of them, without allowing it any other than sedative virtues, which enable it to control in some degree the excitements general and local, which sustain the morbid action, or in which it may consist. MM. Trousseau and Pidoux recommend it in decided terms, from their own experience, in the form of a cataplasm over the abdomen, in chronic enlargements of the mesenteric glands, and other viscera.

From the same sedative property, and without the necessity of supposing any peculiar alterative influence, it may be occasionally serviceable in obstinate *cutaneous diseases*, in which it has been recommended, such as *elephantiasis*, *lupus*, &c., to the cure of which, however, it is wholly inadequate.

In addition to the uses above mentioned, hemlock has been employed to check excessive secretion of milk, and as an antaphrodisiac in satyriasis, spermatorrhœa, and nymphomania, in all of which it may prove useful through its sedative property.

Administration. In whatever form hemlock is given, it will be necessary, in order to maintain a given effect, to increase the dose more rapidly than is requisite with most other narcotics; and there

is scarcely any extent to which it may not be carried in this way with impunity; as, from its want of stimulant or corrosive properties, there is no danger of its exhausting the excitability of the system, or of causing serious organic mischief. But one caution is here peculiarly important; namely, when it becomes necessary, during the use of these large doses, to change the parcel of the medicine, never to use the new parcel so freely as the one last employed, lest it might prove to be much stronger, and thus endanger serious results. The medicine is used in the form of powder, extract, and tincture, and in that also of its isolated active principle.

1. The *powdered leaves* may be directed, in the commencing dose of 3 or 4 grains, twice or three times a day, to be gradually increased until some effect is produced; such as a little giddiness, headache, nausea, or feeling of muscular weakness. In this form, however, the medicine is often nearly if not quite inert, and is at present not much used.

2. The *Extract of Hemlock* (EXTRACTUM CONII, *U.S.*, *Lond.*, *Ed.*, *Dub.*) is probably the form most employed. It is the inspissated juice of the fresh plant, and, if made with due care, is an excellent preparation. Too frequently the juice is inspissated by boiling, which impairs its virtues, and probably sometimes quite destroys them; so that the extract is not unfrequently very feeble, and often quite disappoints the expectations of the prescriber. When prepared by evaporation *in vacuo*, at a low temperature, it retains the virtues of the plant to a considerable extent. Another source of its feebleness is the influence of time and exposure, by which it is deteriorated. The best criterion of its efficiency is the development of the characteristic odour, like that of mice, when it is rubbed with solution of potassa. If it have none of this, it may be considered inert, and its strength will be in the proportion of that of the odour. When of very good quality, it gives rise almost to a feeling of the ludicrous, by the strength of the newly developed smell, and its associations. As now supplied to our markets, from our own factories, it is in general much superior to that formerly kept in the shops. The doses of hemlock are usually given at too long intervals. I find that not longer than four hours should, as a general rule, intervene, if it be desired to sustain a constant impression; and a still shorter interval would often be preferable. Two grains may be given at first, and rapidly increased, if necessary, until the point is reached, at which it will produce some effect. It may be administered in pill or solution; but the former is usually preferred.

A *cataplasm* for external use may be made from the extract, by reducing it to a semifluid state with water, and then spreading it over the surface of an emollient poultice, as of flaxseed meal, or bread and milk. From two drachms to an ounce may be employed, according to the size of the cataplasm wanted. In this shape it may be applied to tumours and ulcers, and to the surface of the body over internal affections; but, when it is used to abraded surfaces, the liability to absorption must be borne in mind, and directions left for the removal of the application should unpleasant symptoms occur.

An *ointment* may also be made from the extract by rubbing it with three or four times its weight of lard. This may be employed as a dressing for painful ulcers, or an application to irritated piles.

3. An *Alcoholic Extract* (EXTRACTUM CONII ALCOHOLICUM, *U.S.*) is directed by our national code, to be prepared by evaporating a tincture of the leaves. Its strength, of course, will depend on that of the leaves, and it cannot, therefore, be relied on. The dose is the same as that of the ordinary extract.

4. A *Tincture of Hemlock* (TINCTURA CONII, *U. S.*, *Lond.*, *Ed.*) is also officinal. When this, according to the U. S. Pharmacopœia, is prepared from the dried leaves, it is liable to all the objections which apply to the leaves themselves; but made, as ordered by the Edinburgh Pharmacopœia, from the fresh leaves, with the addition of the expressed juice, it is a good preparation, and offers the advantage of probably changing less with time, in consequence of the preservative influence of the alcohol. Its goodness may be measured by the strength of the peculiar odour it emits, when a little of it is rubbed with potassa. The dose is from 30 minims to half a fluidrachm.

5. CONIA. Conia is best obtained from the fruit, before it has become dry. It may be obtained by distilling a mixture of an alcoholic extract of the seeds with strong solution of potassa. The acid of the native salt of conia is seized by the potassa, and the liberated alkaloid rises with the vapour of the water, and floats upon its surface in the receiver after condensation.

Properties. Conia is a yellowish liquid, with the aspect of an oil, lighter than water, of a strong, penetrating, mice-like odour, and a very acrid benumbing taste. It is very volatile, and rises with the vapour of water when boiled with it; but its point of ebullition when alone is 370°. It is slightly soluble in water, and freely so in

alcohol, ether, and the fixed and volatile oils. It unites with one-third of its weight of water to form a hydrate, which has a strong alkaline reaction. With the dilute acids it forms soluble salts, but is decomposed by the stronger acids. Its vapour produces white fumes with that proceeding from liquid muriatic acid. Tannic acid forms with it an insoluble compound, and therefore precipitates it from its solutions. When exposed to the air, it is gradually decomposed, being converted into a resinous matter and ammonia. This change takes place rapidly when it is heated. It consists of nitrogen, carbon, and hydrogen.

Effects on the System. These appear to be identical with the effects of hemlock itself. It is an energetic poison. A single drop of it introduced into the eye of a rabbit, killed the animal in nine minutes; and three drops in the eye of a stout cat proved fatal in a minute and a half. It is stated not to dilate the pupils when thus applied. Dr. Christison observed that it first paralyzed the voluntary muscles, then those of the chest and abdomen, and finally the diaphragm, producing death from asphyxia. Sometimes there were tremors and convulsive twitchings of the limbs. Sensation did not seem to have been destroyed, so long as observation could be made on this point. The alkaloid is locally irritant.

Therapeutic Application. Conia has not been introduced into general use; but has been employed by some practitioners with signal advantage. Dr. Spengler, of Herborn, gave it to a child a year old, affected with hooping-cough, in the dose of one-sixteenth of a grain every six hours, with the asserted effect of curing the disease in ten days. (*Ann. de Thérap.*, 1853, p. 73.) Fronmüller considers it as having all the powers of hemlock, without its uncertainty. He has found it specially useful in scrofula, and more particularly in scrofulous ophthalmia, when attended with excessive sensibility, spasm of the eyelids, photophobia, shedding of tears, and severe pains. He dissolves 3 or 4 drops of conia in 15 grains of alcohol and 300 of distilled water, and gives from 15 to 30 drops, in a cup of sweetened water, three times a day. The worst effect he had witnessed was sometimes a little headache and vertigo, though he had continued the medicine for months. (Trousseau and Pidoux, *Trait. de Thérap.*, 4e éd., ii. 118.) Professor Mauthner, of Vienna, has found the topical use of the remedy extremely beneficial, in the same scrofulous affections of the eyes, with photophobia and spasmodic closure of the lids. He dissolves half a grain in a

drachm of almond oil, and pencils the eyelids with the solution two or three times a day. The most obstinate cases yield in a week or two. He finds the same remedy useful in indolent glandular swellings of the neck. (See *Am. Journ. of Med. Sci.*, Jan., 1855, p. 253.) Professor Murawjeff, a Russian physician, has used conia externally, with much success, in not a few diseases. He has employed it successfully in chronic cutaneous eruptions, as *lichen*, *prurigo*, *psoriasis*, *eczema*, *acne*, and *porrigo* or *favus*. One drop of it, in the hollow of a *carious tooth*, allays the pain more rapidly and effectually than chloroform. In *neuralgia* and *syphilitic pains* it effects radical cures. It is beneficial, also, as an anodyne, in chronic *synovitis*, *scrofulous and rheumatic inflammation of the eyes*, *and scrofulous and cancerous ulcers;* and relieves the pain of *wounds*. In affections of the skin, the Professor uses an ointment made with from 12 to 24 drops of conia and an ounce of simple ointment or cold cream. In neuralgia he first washes the part with alcohol, and then applies three or four drops of the conia. In both instances he covers the part after the application with oiled silk and a bandage. In cancer, he applies the liquid mixed with mucilage. For a collyrium, he adds from 1 to 3 drops to a fluidounce of weak mucilage of quince seeds, and as an enema gives two or three drops in an emulsion of starch. (*Ibid.*, July, 1855, p. 187.) From the above data, I should infer that from half a drop to a drop might be given to an adult for a commencing dose.

IV. LACTUCARIUM. *U. S.*, *Ed.*, *Dub.*

Syn. Lettuce-opium.

Origin. The name of lactucarium has been given to the concrete milky juice of *Lactuca sativa*, or common garden lettuce, and of other species of Lactuca, especially *L. virosa* and *L. altissima*, which are natives of Europe. It is procured from the stem; as, before this rises, the leaves which constitute all of the plant now above the ground, contain little or none of the milky juice; though, as brought upon the table, they often have a narcotic smell, and induce drowsiness when freely eaten. It should be collected about the time when the flowers begin to blow; for, if procured later in the season, though the juice may be thicker, it contains, according to Mr. Duncan, of Edinburgh, less of the bitter matter on which its virtues probably depend. The mode of gathering it, is to cut off

the stem, or incise it longitudinally, and then either absorb the juice which exudes with a piece of sponge or a little cotton, and press it out into a vessel, or scrape it off with the finger or a knife. The juice concretes spontaneously into a solid substance, which is the lactucarium. Our shops are supplied with it from abroad.

Properties. As found in our shops, it is in small, irregular, light, and friable lumps, of a reddish-brown colour, a narcotic odour strongly recalling that of opium, and a bitter taste. It was this resemblance of its sensible properties to those of the medicine referred to, that gave origin to the name of *lettuce-opium* by which it has been occasionally designated.

Lactucarium is said also sometimes to be in the form of roundish compact masses, weighing several ounces; and, according to Dr. Christison, this is the condition in which it is collected from the garden lettuce; while the variety above described is obtained from the Lactuca virosa, or wild-lettuce. Another form, in which it is prepared on the continent of Europe from L. altissima, is that of round flat cakes.

Active Principles. From the strong resemblance of the sensible properties of lactucarium to those of opium, it was at one time conjectured that morphia would be found among the ingredients; but this, upon investigation, has not proved to be the case. The odorous principle distils over with water; but, though it is probably a volatile oil, and may have narcotic properties, it has not been sufficiently investigated to justify any positive opinion on the subject. A bitter, crystallizable, neuter principle named *lactucin* is said to have been obtained from lactucarium; but its claims to be considered as the active constituent of the medicine have not yet been satisfactorily determined; and no practical advantage has hitherto accrued from its discovery. Lactucarium yields its virtues to water and alcohol.

Effects on the System. These have not been investigated with so much precision, as to enable a well-grounded opinion to be formed in relation to the precise action of the medicine. That it has a composing and soporific effect cannot be reasonably doubted; but the point is yet undetermined, whether it is essentially stimulant or sedative; and we are equally in the dark as to its accessory properties. While Dr. J. R. Cox inferred, from his experiments, that it had the same stimulant properties as opium, Dr. François, who used an analogous preparation of lettuce, under the name of *thridace*, in France, found it to diminish the frequency and force of the pulse,

and the temperature of the body. If, as stated by Fisher, it should be found to have the property of directly diminishing sensibility, without ever exciting the circulation (*Lond. Med. Gaz.*, xxv. 863); and if Buchner be correct in comparing the influence of lactucin over the pulse, to that of digitalin, and in ascribing to it the properties of lowering the animal heat, dilating the pupil, and producing sleep and stupor; then we shall certainly be justified in placing lactucarium among the cerebral sedatives. So far as can be inferred from other published accounts, the general tendency of experience is in the same direction.

Therapeutic Application. The soporific property of the common lettuce was well known to the ancients, who believed it also to possess antaphrodisiac properties; and Dioscorides speaks of the juice obtained from the wild-lettuce at maturity, as having in a considerable degree the qualities of opium. But to Dr. J. R. Coxe, of Philadelphia, belongs the credit of having first drawn attention to the inspissated juice of the common lettuce as a medicine. He made experiments with it towards the close of the last century, which were published in the fourth volume of the *American Philosophical Transactions*, and from which he inferred that it was identical with the opium procured from the poppy. (*Am. Dispensatory*, A. D. 1806, p. 408.) The elder Dr. Duncan, of Edinburgh, soon afterwards made similar investigations, and, in his treatise on pulmonary consumption, recommended lactucarium as a substitute for opium, the anodyne properties of which it possessed, without being followed by similar disagreeable consequences. Dr. François called attention to the same subject in France; and the consequence was the introduction of the medicine into use, and its adoption as a standard remedy in the officinal codes of Great Britain and the United States.

Though extremely uncertain in its action, from its variable strength, lactucarium may be employed for calming nervous disquietude, relieving pain, and producing sleep, in cases in which, in consequence of the existence of some contraindication, opium cannot be used. Thus, having little or no stimulant influence over the circulation, it may be used in inflammatory and febrile conditions in which the excitant action of opium might prove injurious. Not having, at least in an equal degree, the property of checking the secretions, it is better adapted to the early stages of catarrhal disease; and, perhaps, its most advantageous application is to the alleviation of cough. It is said, moreover, to be less apt than

opium to cause headache, nausea or other disorder of digestion, and constipation; and may agree well with constitutions, which from idiosyncrasy may not be kindly affected by that narcotic.

It has been specially recommended to allay cough in phthisis, catarrh, and other pulmonary complaints; to compose nervous irritation and produce sleep in febrile diseases of all kinds, idiopathic, exanthematous, and symptomatic; and to relieve pain in chronic rheumatism, colic, gastralgia, and excessive sensibility of the eyes. The dose of it is from five to fifteen or twenty grains; that of the alcoholic extract, from two to five grains. The Edinburgh College directs a *Tincture* (TINCTURA LACTUCARII, *Ed.*), the dose of which is from thirty minims to two fluidrachms.

CHAPTER III.

Alteratives.

THESE are medicines which, without essentially elevating or depressing the vital actions, nevertheless produce changes in the organization or functions, which render them available for remedial purposes. The stimulant or sedative power is not incompatible with the alterative. The latter may operate at the same time with one of the two former, either conjointly upon the same, or separately on a different part or function. But, so far as the medicine is an alterative, its curative influence depends, not on the exaltation or depression, general or local, which it may produce, but on changes wholly independent of these effects, and which are usually unappreciable, or at least not obvious in health. In fact, the name is generally applied to medicines which, so far as regards their relation to the system as alteratives, produce no readily discernible change in the healthy state, and are only known to possess remedial powers by the result of their use in disease.

The nature of the change effected by the alteratives may be a subject of conjecture, speculation, or investigation; but has not been determined; for, if satisfactorily known, it would serve as a ground of distinct classification, and the medicine would be removed from the class of alteratives, into another founded on a definite basis. This class, therefore, may be considered as a temporary and convenient receptacle of those otherwise unclassifiable medicines, which experience has proved to be useful in disease, but the modus operandi of which is undetermined.

I have said that we may speculate in relation to the action of alterative medicines; and the conclusions to which we may be conducted by our reasoning on the subject may possibly be correct; but, in the present state of our knowledge, they cannot be demonstrated to be so; and the best that can be said of them is that they are highly probable.

There are various modes in which alteratives may be supposed to

act. Thus, they may change the condition of the blood, and may do so either chemically or dynamically; that is, in the former case, by taking something from, or adding something to that fluid through the influence of affinity, or by causing new reactions among its ingredients through the mere influence of presence, as emulsin, added to a watery solution of amygdalin, causes a reaction resulting in the generation of hydrocyanic acid; or, in the latter case, by operating on the vital susceptibilities of the living constituents of the blood, and changing it through modifications in the actions of these constituents. The chemical result might be produced equally in the blood removed from the body, and destitute of life; the dynamic results could happen only in the fluid while still living. Thus, alkalies may be supposed to render the fibrin of the blood more soluble, and in this way diminish its coagulability; while the presence of mercury in the circulation may bring about the same result by poisoning the fibrin, as it were, and affecting it through its vital properties.

Another mode in which the alteratives may be supposed to act, and probably do act, is by modifying the state of the solid tissues; and here too they may either exert a chemical agency upon the structure, combining with it, or in some measure decomposing it, or may simply affect its functions through its vital susceptibilities, without undergoing any change themselves, or producing any chemical change in the tissue.

A third method, in which the alterative may be imagined to act, is by neutralizing, decomposing, or eliminating some noxious agent that may exist in the system, either the result of some pathological process, or introduced from without. Thus, it has been conjectured that mercury cures syphilis by destroying the peculiar contagious virus, the presence of which in the body causes and sustains that disease; colchicum has been supposed to cure gout by eliminating uric acid and urea through the kidneys; and there is good reason to believe that iodide of potassium acts favourably in lead-poisoning, by dislodging the lead from its seat in the tissues, and forming with it a compound soluble in the blood, and thus capable of elimination.

Still another mode of operation, to which fancy has ascribed the efficiency of alteratives in certain diseases, the cutaneous eruptions for example, is by a poisonous action on the sporules of microscopic fungi, or on the fungi themselves, which may be imagined, by circulating in the blood, to take root in various tissues, and produce disease by their growth and propagation.

Each one or all of the above methods of alterative action may possibly be true; but no one of them can be said to have been positively demonstrated; and, in the mean time, the medicines may continue to rank with the alteratives, until experimental investigation shall have satisfactorily settled their claim to another and better defined position.

The alterative property is by no means identical in the different individuals of the class. Each probably has a mode of action more or less peculiar to itself, adapting it specially to certain curative purposes. Thus, mercury has extraordinarily curative powers over inflammation, arsenic over chronic cutaneous diseases, iodine over scrofula, and colchicum over gout.

It is obvious, from the foregoing remarks, that the applicability of the alteratives to the several diseases in which they have been found useful or curative, is a point to be determined only by experience. It is on this ground alone, and not that of *à priori* reasoning, based upon their known physiological action, that their special application in practice must rest. There is little, therefore, to be said of them in common, in relation either to their effects on the system, or therapeutic application. Each one of them must be considered separately in all its relations.

Most of the medicines here treated of as alteratives have also other properties, which might attach them to other classes of medicines; and, again, there are many medicines which, though usually employed in reference to certain well known physiological methods of operating, and therefore considered in other classes, have also alterative properties, which render them occasionally useful in diseases, in which the class with which they are associated are not indicated. Thus, mercury, which is the most efficient alterative, often does good by increasing the various secretions, and, in one of its combinations is an excellent cathartic, and in another a tolerably certain emetic; on the other hand, tartar emetic, which is usually employed for its sedative or emetic property, or for its stimulant influence over the secretions, sometimes does good in disease without any discoverable modification of the functions, or, in other words, by an alterative operation. These accessory qualities are either considered incidentally to the main property upon which the classification of the medicine depends, or serve as the basis of a double or triple position in different classes, as their relative importance may seem to demand.

I. MERCURY.

HYDRARGYRUM. *U. S., Lond., Ed., Dub.*

Syn. **Quicksilver.—Argentum Vivum.**

Though known to the ancients, mercury does not appear to have been used by them as a medicine. The Arabian physicians employed it externally in cutaneous diseases; and, in the same mode of application, it was recommended in syphilis by Widmann, in a work published in 1497; but the noted Paracelsus, who flourished in the earlier part of the following century, is said to have been the first to venture on its internal use. I shall first treat generally of its effects on the system, and therapeutic application, and afterwards of its several preparations, with what is peculiar to each.

1. *Effects on the System.*

Given in very small quantities, so as to produce no obvious physiological effect, mercury often operates most beneficially in disease. More largely administered, it gives rise to a peculiar condition of system, attended by certain characteristic phenomena, which, in the aggregate, are produced by no other cause or combination of causes. One of the first and most striking of these symptoms is sore-mouth with salivation. Hence, this systemic effect of mercury may be distinguished as its *sialagogue operation;* not that the affection of the mouth is at all essential to the condition, but because it is one of the most characteristic and available signs. Some give the name of *mercurialism* to this general influence of the metal; and it is perhaps as convenient as any other. Under these two heads of its *insensible operation*, and its *sialagogue influence* or *full mercurialism*, together with that of its *local action*, may be considered all the physiological effects of mercury, and its remedial applications. In relation to those effects of certain mercurials which serve to rank them in other classes, as the purgative effect of calomel, the emetic of turpeth mineral, and the caustic of corrosive sublimate, they will be fully considered elsewhere, and may be left out of view in this place, where we are to consider mercury in reference to its peculiar or alterative properties.

a. *Local Effects.*

In its pure, uncombined state, the metal is quite without topical effect, and any irritation that may seem to proceed from those of its

preparations in which it exists mainly in minute division, as the mercurial ointment for example, may be ascribed either to the material with which it is incorporated, or to some chemical change of the metal itself. Its insoluble proto-combinations, as calomel and the black oxide, are very slightly irritant; its insoluble deuto-combinations, as the sesquioxide and subsulphate, are much more so; and its soluble compounds of the latter character, as corrosive sublimate and red iodide, are extremely irritant, and even corrosive or caustic. Of course, when taken into the stomach, there is the same difference in their irritant influence upon the alimentary mucous membrane. Hence, while the preparations first mentioned occasion little disturbance in the stomach and bowels, the latter and more acrid compounds not unfrequently cause vomiting and purging, and, in large doses, may excite violent and even fatal inflammation.

b. *Insensible Operation.*

This is the genuine alterative operation of the medicine; as its remedial influence is exerted with little or no obvious disturbance of the healthy functions. Nevertheless, a close observation will sometimes detect evidences of the action of the medicine, even in health. There is not unfrequently some uneasiness in the stomach and bowels, occasionally amounting to slight griping pains; and, if the stools are examined, they will be found in general of a deeper or brighter yellow than in their normal condition. It is evident that the alterative action is exerted chiefly on the liver, the function of which is somewhat augmented. In consequence of the increased secretion of bile, the peristaltic action of the bowels is moderately promoted; and it is from the presence of the same agent, probably, that the sensations above referred to are experienced. In some persons, the susceptibility of the liver to this influence is so great, that very minute doses, even a single grain of the blue pill, or one-quarter of a grain of calomel, will produce a sensible effect; and three grains of the former, or a grain of the latter will operate as a cathartic, with bilious stools. In others, less susceptible, there will only be a slight increase in the softness of the passages, and a somewhat greater tendency to alvine evacuation; while in others, again, no apparent effect whatever will be experienced. Why the liver should feel more sensibly than other organs this first impression of the medicine is quite intelligible. The absorption takes place, not through the lacteals, but the radicals of the veins which empty into the vena portæ; and the medicine is, therefore, first distributed throughout the liver, coming into intimate contact

with its secreting tissue, and acting upon this, before it can reach the system generally through the hepatic vein, and the ascending cava. A portion of it may possibly be carried out again with the bile into the bowels, and another portion be detained in the tissue of the liver; so that but a small part of the medicine administered may enter the general circulation. Hence, probably, it is, that no sensible influence is exerted upon the system at large. Nevertheless, experience has shown that other therapeutic effects, besides those dependent on a change in the hepatic function, are often experienced from this insensible operation of mercury; and some of the medicine must consequently escape the secretory and detaining force of the liver, and enter into the general system. If this explanation is correct, the external application of mercury should be attended with less of this preferable influence upon the liver; and such has been uniformly the result of my own observation. Few, I presume, would expect so energetic an alterative action on the liver from mercurial inunction, as from the internal use of calomel or the blue pill; and yet the sialagogue operation can usually be thus obtained with great facility.

c. *Sialagogue Operation, or Full Mercurialism.*

This may be induced in two methods; either rapidly, by large doses at once, or more gradually and safely, by small doses more or less frequently repeated. The effect is very complicated; the most prominent phenomena being sore-mouth with salivation, excitement of the circulation, increase of the secretions generally, a more rapid absorption, more or less disturbance of the digestive function, and a greater sensitiveness of the nervous system. Each of these effects requires a separate notice.

Salivation.—Ptyalism. The first phenomenon presented is often a whitish appearance of the lower gums, probably owing to opacity of the epithelium. Soon afterwards the gums are seen to be somewhat swollen, rising up between the teeth, and reddened at their edges. At the same time, they are somewhat tender to the touch; and not unfrequently pain is produced at the roots of the teeth, by firmly closing the jaws. In some instances, the pain in the throat on swallowing is the first sign of the action of the medicine. A metallic taste, as of copper in the mouth, is also among the first symptoms; and I have repeatedly been able to detect the approach of salivation by the peculiar fetor of the breath, before any other sign had presented itself. It not unfrequently happens that the above symp-

toms have existed for some time, before any increase of saliva appears; and occasionally there is at first even a dryish condition of the tongue. Sometimes, however, though rarely, the salivation or ptyalism has precedence of all the other phenomena. There is also an increased production of mucus in the mouth and fauces.

For therapeutic purposes, there is no occasion for any greater effect on the mouth than as above described; but not unfrequently, even when all due caution is observed, the affection is considerably increased. The gums, tongue, cheeks, and fauces, one or all, swell and become painful; deglutition is painful; the teeth, if carious, begin to ache; the tongue is somewhat furred, and indented by the teeth at its edges; the saliva is discharged copiously; the salivary glands swell, together with the neighbouring areolar tissue; and the breath is very offensive, having a peculiar fetor which distinguishes the mercurial sore-mouth from all other analogous affections.

Beyond this point the sore-mouth should never be allowed to proceed, if it can possibly be prevented. But, if the medicine be persevered with, or has originally been given in too large a dose, and in very susceptible persons even from small doses, the affection sometimes becomes greatly aggravated, and, in its severest grade, may be considered poisonous, as it is not without danger. The swelling internal and external increases; the tongue sometimes projects from the mouth, in consequence of its greatly augmented bulk, and is covered with a very thick, soft, yellowish-white fur, extremely offensive to the smell; the parotid and submaxillary glands become much enlarged and painful; the patient cannot open his jaws, swallows with great difficulty and pain, and is wholly unable to articulate; the head requires to be supported on a pillow, and the saliva runs in streams from the mouth; the odour of the breath is insupportably fetid, and sometimes scents the whole apartment; ulceration of the gums, cheeks, and tongue takes place, with occasionally copious and exhausting hemorrhage; the teeth loosen and fall out; even gangrene of the soft parts, and necrosis of the alveolar processes sometimes occur; and, in not a few instances, death has taken place, or recovery has been attended with revolting or very inconvenient deformity. One of the greatest dangers is from the hemorrhage; though a fatal result may also be owing to the joint effect of gangrene and a depraved state of the blood. I have never, however, witnessed a fatal case of ptyalism; and, with due caution in the use of the medicine, the cases must be extremely rare, indeed,

in which such an event can happen. In all my intercourse with medical men, I have heard of but one instance in which the fatal result might not have been avoided; and in that case death was ascribed, whether justly or not I cannot say, to the local effects upon the mouth induced by a few grains of blue mass. This is no argument against the use of mercury as a remedy; for the same might be urged against the most innocent medicines, which, in certain peculiar states of the constitution, may prove highly mischievous. In a person predisposed to cholera, a teaspoonful of castor oil may bring on a fatal attack; and the scratch of a pin has occasioned death from erysipelas or tetanus. The possibility, however, of these tremendous effects from mercury, should teach us always to be most watchfully on our guard against its abuse.

Excitement of the Circulation. Even under the moderate influence of mercury, the circulation is often accelerated; and I have sometimes thought that I could detect an approaching ptyalism, even before any effect had been produced on the mouth, by a peculiar quick, jerking, and irritated movement in the pulse. This direct effect of the medicine on the circulation is much increased by severe sore-mouth; and not unfrequently a fully formed febrile condition is induced, with frequent pulse, headache, furred tongue, loss of appetite, and various nervous derangement.

Increase of the Secretions. This is one of the most prominent and important effects of mercury. Not only is the *salivary secretion* increased, sometimes enormously; but there is perhaps not one of the secretory functions which is not liable to be similarly affected, though rarely in an equal degree. The *hepatic secretion* is often energetically stimulated, especially when the medicine is administered internally. There is no cholagogue which approaches in efficiency some of the preparations of mercury. A true cholera morbus, with copious vomiting and purging of bile, is not unfrequently induced by a large dose of calomel. It has been already stated, that an increased production of this fluid may result from doses of the mercurials, insufficient to cause any other observable effect on the system. I consider this as one of the most certain and best proved effects of mercury; and, though it has been questioned, I have, from personal experience and observation, no more doubt on the point than upon the cathartic property of castor oil. There is every reason, moreover, to believe that the pancreas is stimulated to increased action. It is certain that copious sweating and diuresis occasionally attend the operation of the medicine, though not

in general simultaneously. A soft, rather moist, and relaxed state of the skin is a very common effect. The mucous secretion is also promoted in all the different membranes, but not often very greatly increased, unless in the mouth and fauces.

Absorption. That this process is promoted by the medicine, is inferrible from the obvious loss of flesh which takes place during the existence of mercurialism, amounting not unfrequently to great emaciation. It is probable that the mercury acts, not so much as a direct stimulant to the absorbents, as by promoting that molecular change or disintegration of structure, which always occurs in the performance of the various functions, even that of nutrition, and thus throwing a greater amount than in health of the detritus of the tissues into the lymphatics and veins. It is not improbable that much of its alterative action in disease, is owing to the change which it thus produces in the intimate structure of the organs.

Effects on the Digestive Organs. These are always disturbed in full mercurialization. The diminution or loss of appetite is among its most common accompaniments. Even independently of the local irritant impression on the alimentary mucous membrane, produced by the more acrid preparations of the metal, there is a disposition to looseness of the bowels, and not unfrequently a purgative effect, resulting in chief from the increased production of bile, but probably in part also from the augmented mucous and pancreatic secretion.

Effects on the Nervous System. The most prominent nervous phenomenon of mercurialization is an increased susceptibility to impressions; slight causes producing a disturbance of the mental equanimity, and unpleasant influences of all kinds having more than their ordinary effect. A fretful, peevish state of mind, and irritable condition of temper are not uncommon; and restlessness, wakefulness, and general uneasiness are frequently added to the other sufferings. Much of this may be owing to the local affection of the mouth; but there is reason to think that the nervous centres are more or less disturbed by the direct contact of the medicine, as it is carried to them with the blood. In very severe cases of mercurialism, tremors and convulsive movements are sometimes produced. When mercury is received into the system by inhalation, it is said to be peculiarly apt to cause derangement of the nervous functions.

Effects on the Blood. It is the almost uniform testimony of writers and observers that the effect of mercury is to lower the

quality of the blood. The particular changes produced in this fluid will be noticed under another division of the subject; but it is probably owing to its deterioration that the patient, suffering under the continued and considerable influence of the medicine, is apt to become pale, with a puffy face, and edematous extremities, and sometimes a disposition to hemorrhage; though I do not remember to have noticed the last mentioned result in any case that I have witnessed, except as an attendant upon a severe affection of the mouth and fauces.

Convalescence from Mercurialism. From a moderate degree of mercurialism, if the medicine be omitted, the patient begins to recover after an uncertain length of time, and gradually returns to health, with no other effect remaining than perhaps a greater susceptibility, for a time, to the morbid influence of cold, requiring care to guard against undue exposure.

The more violent forms of the affection are generally slow in convalescence; leaving behind them sometimes a tendency to a rapid decay and ultimate loss of the teeth, and, in rare instances, deformity of the face from the loss of portions of the jaw bone, or contracted mouth, adhesions between the tongue and cheek, and difficulty of separating the jaws, in consequence of ulcerated surfaces having united together, or shrunk in the healing process. I have seen few or no cases, in which the health appeared to have undergone permanent and irreparable injury; but, on the contrary, have known very happy changes in the constitution to have been effected, and long continued morbid tendencies, occasionally threatening life itself, to have been to all appearance permanently eradicated.

Difference of Susceptibility. There is in different individuals very great difference of susceptibility to the sialagogue operation of mercury. The smallest doses ordinarily administered will sometimes produce unexpectedly violent effects; and there are individuals whom it is impossible to affect by any quantity which it is at all prudent to administer. The most violent and threatening case of mercurial sore-mouth that I have seen, occurred in a young woman to whom I gave eight grains of calomel in the course of three days; and, in the Pennsylvania Hospital, I once had a patient who was profusely salivated, as I was assured by the resident physician, by one-third of a grain of corrosive sublimate in two doses. Dr. Burrows, of Jackson, N. C., in a letter to me dated January, 1844, informed me of a case, in which five-eighths of a grain of calomel

had acted powerfully as a sialagogue upon an adult. In those persons whom, from idiosyncrasy, I have found it difficult or impossible to salivate, I have repeatedly observed an unusual aptness to be purged by the medicine; and have ascribed the constitutional insusceptibility to this very circumstance. The medicine, being absorbed into the portal circulation, and distributed through the liver, from the extraordinary susceptibility of this organ to be affected by it, is thrown off with the bile, which serves as a purgative upon entering the bowels. Whether such individuals would offer an equal insusceptibility to the sialagogue action of the medicine, introduced into the system by inunction or endermically, I have never experimentally ascertained. In others, with a similar constitutional insusceptibility, without any special disposition to be purged by the mercurial, I have noticed frequency of pulse to be induced, without alarming symptoms of any kind. What might have been the ultimate results of perseverance I cannot say, for I have never carried the medicine beyond what I conceived to be safe limits. But it is highly probable that effects on the nervous system would have been produced, similar to those which will be noticed directly as sometimes resulting from the habitual inhalation of the vapour.

Infants are remarkably insusceptible to the sialagogue operation of mercury. Nevertheless they are now and then even profusely salivated; and, where the salivary glands have not been affected, I have, in a very few instances, noticed ulcers of the mouth produced, which I could ascribe only to the medicine. But in no instance have I seen injury ultimately result.

Disease often greatly affects the susceptibility to the mercurial impression. In Bright's disease, at least that variety of it which may be ascribed to fatty degeneration of the kidneys, the system is often affected with extraordinary facility; while in certain violent and malignant fevers, in which the blood is greatly diseased, as in malignant cases of yellow fever, it is often impossible to induce salivation. I once saw the experiment tried in a young man extremely ill of yellow fever. Calomel was poured into him in indefinite quantities, and mercurial ointment was most energetically applied over almost his whole surface, but without success.

Occasionally mercury, after having been administered for some time without effect, has been abandoned; and, after a long interval, mercurialism has apparently taken place, without, so far as was known, any renewed exhibition of the medicine.

A *cumulative effect* is sometimes also exhibited by the medicine. After having been exhibited for some time without obvious phenomena, it begins to operate with great energy, as if the whole quantity taken had come at once into action.

Irregular and Poisonous Effects. Ordinary mercurialism, as already described, may be carried so far as to prove poisonous. The patient may die of hemorrhage from the mouth, of the exhausting effects of gangrene and necrosis of the fauces, jaws, or face, or of a general cachectic condition, aggravated by the local affection.

But there are also abnormal effects of mercury, which may become sources of danger or solicitude. Sometimes, instead of throwing itself mainly upon the mouth and neighbouring parts, it acts more especially upon the great vital organs, producing much disturbance of their functions, and profound debility. Such a condition is described by Dr. Pearson, as sometimes resulting from the abuse of mercury in the hospitals. The symptoms stated by him, are small and frequent pulse, precordial anxiety, pale and contracted countenance, great nervous agitation, and alarming general weakness. In this condition, death sometimes follows any sudden effort, such as rising from bed and attempting to walk. I have never witnessed this effect of mercury.

When given in states of system in which the blood is already greatly depraved, and especially when there is existing ulceration with a phagedenic tendency, or disposition to passive hemorrhage or gangrene, mercury has sometimes appeared to aggravate the affection, causing a more rapid progress of disorganization, and hastening the fatal issue; perhaps producing it, when it might otherwise have been avoided. This, however, is not peculiar to mercury. Any other agent which has the property of lowering the quality of the blood, of diminishing its plasticity, and impairing as well its reparative as its supporting properties, would have the same effect. It has thus proved injurious in certain cases of scrofulous, syphilitic, and cancerous cachexia, and other analogous conditions of system. It may have even, in some instances, so far impaired the blood through its own unaided influence, as to give an aggravated and alarming character to any accidental wound or ulcer. It has, however, no special tendency to cause ulceration elsewhere than in the mouth; and here the affection is a mere result of the inflammation, though no doubt aggravated, and ren-

dered more difficult of cure by the depraved state of the blood in some cases.

Sometimes mercury, instead of acting as usually upon the mouth, throws its whole force apparently on *the nervous centres*, producing *paralytic phenomena*, and other evidences of impaired nervous power. This is said sometimes to have been the case where it has been administered internally; but I have never witnessed the effect, and have no doubt that the result has often been ascribed to the mercurial influence, when it was nothing more than a sequence, and really dependent on other causes, perhaps upon the very disease which the mercury was given to relieve. But there is no reason to doubt the occurrence of a state of system, to which the name of *shaking palsy* or *mercurial palsy* has been given, as an effect of habitual exposure to the vapours of the metal. This affection is most apt to occur among the workmen engaged in metallurgic or manufacturing processes, in which the air becomes necessarily more or less impregnated with the vapour of the metal, as in the mining and melting of mercurial ores, the silvering of mirrors, &c. The constant inhalation of these vapours is said to occasion wandering pains; mental hebetude; trembling of the muscles, beginning in the arms, and extending more or less over the body; sometimes stammering; vertiginous sensations, and failure of the memory; and at length, if the exposure continue, paralysis, epileptic convulsions, delirious hallucinations, imaginary terrors, coma, and death. Sometimes palsy of one or more of the limbs has been noticed, as an attendant or result of severe mercurialism of the ordinary character.

An eruptive affection, variously denominated *eczema mercuriale*, *erythema mercuriale*, *lepra mecurialis*, and *hydrargyria*, sometimes accompanies mercurial influence, but whether always an effect of the mercury may be doubted. The eruption, as I have seen it, has accompanied profuse sweating, proceeding from other causes than the mercury, and, like the ordinary sudamina or miliary eruption so common in that state of skin, might have been ascribed as fairly to those other causes as to the mercury. The affection consists in the eruption of innumerable minute vesicles, with more or less redness, itching and soreness, and a rough feeling under the fingers, sometimes extending over the whole body. They often at the first glance appear like small papulæ, but a close examination shows that they are filled with a clear liquid. In two or three days this has become turbid and opaque, and the vesicles attained the size of

a pin's head; after which they generally dry up, and desquamation of the skin follows. They are said occasionally to break, and produce excoriated surfaces, which discharge serum copiously, like those of eczema rubrum, and from which, when they heal, the epidermis separates in large flakes, and sometimes with the loss of the hair and nails. I have never seen anything which could be at all ascribed to mercury exhibit these latter phenomena; though I have frequently witnessed similar cases of eczema rubrum, which, if mercury had by accident been taken, would probably have been ascribed to it. I have little doubt that the fatal cases of mercurial eczema, reported by some writers, were independent of mercury, and had but an accidental connexion with that medicine.

Excessive sweating is sometimes caused by the mercurials, and is accused of having produced dangerous exhaustion.

As to the various *chronic skin diseases*, the *pains in the bones with nodes*, the *chronic enlargement of the lymphatic glands*, the *ulcers*, like those of syphilis, in the *fauces and upon the surface of the body*, the *iritis*, &c., &c., which have been ascribed to mercury, I believe that it is wholly guiltless of all of them.

Treatment of Excessive Mercurialism. For the sore-mouth, weak astringent washes may be used, as infusion of green tea, galls, sage, or cinchona, water acidulated with sulphuric acid, or solution of acetate of lead, sulphate of zinc, or alum. I have usually employed acetate of lead, in the proportion of two or three grains to the fluid-ounce of water; though it has the disadvantage of temporarily blackening the tongue and teeth, by forming sulphuret of lead. Solution or honey of borax, and tar-water, or smearing the inflamed parts with tar itself, have been recommended. Velpeau directs his patients to rub a little powdered alum on their gums, three or four times a day. Dr. Watson has found nothing better, for correcting the excessive flow of saliva, than a mouth-wash composed of one part of brandy to four or five of water. Tincture of iodine, or the compound tincture diluted with water, is said to have proved very efficacious. To correct the offensive odour, solutions of creasote, chloride of soda, or chloride of lime in water may be used; one part of either of these substances being dissolved in 100 parts of water. Charcoal, in fine powder, has been employed for the same purpose. When there are painful or obstinate ulcers, they may be touched with a strong solution of nitrate of silver.

The mercurial must of course be suspended on the occurrence of unpleasant symptoms. Exposure to cold and dampness should be

avoided, and the patient should wear flannel next his skin. It is said that the sudden checking of profuse salivation by a cold damp air has caused internal pains, irritation of stomach, and even convulsions. To relieve the local pains and restlessness, opium may often be given advantageously by the mouth. If the pain and swelling of the parotids are considerable, leeches may be employed with relief, and even blisters may be applied in obstinate cases. Should the tongue be much swollen, leeches should be applied under the chin. The saline laxatives may also be given, and, if there is fever with a hot skin, the neutral mixture or effervescing draught. Certain medicines, taken internally, have been much praised as having peculiar efficiency in arresting the mercurial influence. Among the substances recommended for this purpose are tartar emetic, acetate of lead, nitre, iodine, sulphur, and chlorate of potassa. The last mentioned salt has recently been used with great supposed advantage by MM. Herpin and Blache. They give from thirty grains to half a drachm in the course of the day, and cure their patients in from four to six days. (*Bull. de Thérap.*, xlviii. 26 and 120.) In prostration, with gangrene or necrosis, it will be necessary to have recourse to quinia, opium, the fermented liquors, and nutritious food. In anemic cases, the chalybeates should be employed.

Should the poisonous action described by Pearson be induced, the patient should be removed into a pure air, duly stimulated, and nourished with milk, or other easily digested and nutritious food.

For the nervous disorders resulting from the inhalation of the vapours of mercury, and all other cases of chronic poisoning from the medicine, iodide of potassium, as recommended by M. Melsens, would probably be the best remedy, in conjunction with tonics. From five to ten grains or more may be given three times a day. In these cases, it is probable that the metal is fixed in the cerebral or nervous tissue, from which there may be good hope that the iodide will disengage it. If, upon re-entering the circulation, it should produce salivation, this would soon cease with the discharge of the metal by the emunctories, and no harm would result.

For the affection of the skin (eczema mercuriale), the best treatment consists of demulcent lotions, emollient baths, and, in case of fever, the saline laxatives and refrigerant diaphoretics.

Excessive sweating must be combated by sulphate of quinia and the mineral acids.

2. *Mode of Operation.*

That mercury is absorbed is proved by the following facts. When rubbed upon the skin it in part disappears. After administration, it has been detected by chemical tests in the blood, saliva, perspiration, bile, and urine, and is said to have been found in the metallic state in the brain, bones, cellular tissue, lungs, &c. Infants affected with syphilis are asserted to be treated effectually by the administration of mercurials to the nurse. After the use of sulphur for some time, the exhibition of mercury has been followed by blackening of the skin; from which it is inferrible that both substances were thrown out of the circulation with the cutaneous transpiration, and combined after elimination to form the black sulphuret of mercury. Gold, worn about the person of individuals under the influence of mercury, is said to become whitened by amalgamating with that metal escaping with the perspiration. Should all these statements not be admitted as sufficiently authentic, enough will still remain, of which there can be no reasonable doubt, to establish the fact of the absorption of the metal. It is not necessary to suppose that it enters the blood in an uncombined state. On the contrary, it may be considered as almost certain that, when presented in a finely divided state, either incorporated with other substances, or in the form of vapour, to any absorbing surface, whether that of the alimentary mucous membrane, the pulmonary air-cells, or the skin, it meets before absorption, or in the act of being absorbed, with substances which, by combining with it, render it soluble in the blood. M. Mialhe has shown that metallic mercury, in contact with the air and the solution of an alkaline chloride, is partially converted into the soluble bichloride of mercury, or corrosive sublimate, and may in this, if in no other mode, find access into the circulation. The simple fact that its effects upon the system are obtained, no matter to what surface capable of absorption it may be applied, is alone a sufficient proof that it operates through this agency.

Admitting then that all the mercurial effects, except those strictly topical, result from its entrance into the circulation, the next inquiry which suggests itself is, in what method precisely it produces these effects.

It is a very common opinion, which seems to rest on incontrovertible evidence, that it affects the character of the blood itself. After the occurrence of sore-mouth, this fluid is stated, when drawn

from the body, to present the buffy coat of inflammation. The experiments of Dr. Samuel Wright have determined that its solid constituents are notably diminished, including albumen, fibrin, and red corpuscles; that *it abounds in fetid, fatty matter;* and that it is more than ordinarily prone to decomposition. The coagulability is impaired, and the coagulum softer than in health. The pallid aspect of those under its influence proves, without the necessity of experiment, the deficiency in red corpuscles. That the mercurial should produce these results by a direct chemical agency, is an idea wholly incompatible with the minuteness of the quantity absorbed. The best explanation seems to be, that it operates upon the vital properties of the red corpuscles and fibrin, lowering their grade of vital energy, and disposing them to fatty degeneration. Hence the excess of fat, at the expense of these ingredients. The offensive odour of the fatty matter is another evidence of the deterioration which has been undergone in the change. The buffy coat only evinces a relative excess of fibrin over the red corpuscles, not an absolute excess of the former, and cannot be admitted as proof of a sthenic condition of the blood. This depreciation in the character of the circulating fluid is probably one of the agencies, through which mercury exercises its therapeutic influence. It no doubt contributes to the cachectic condition, which characterizes the prolonged and excessive action of the medicine.

But the mercury has also a direct influence over the various solid tissues, which it affects according to their several peculiarities of susceptibility. Its general action appears to be irritant. The heart is stimulated to increased action. The tissues of the mouth appear to be peculiarly susceptible, and to suffer accordingly. The digestive apparatus feels the disturbing influence, in part perhaps from the direct action of the mercury, but probably still more from sympathy with the inflamed mouth, and the injurious influence of the impaired blood. The various secretory functions are stimulated, in order that they may eliminate the injurious agent. I have already endeavoured to explain why the hepatic function is specially affected. The excessive flow of saliva may be referred in part to the stomatitis. There can, I think, be little doubt that mercury has a special tendency to act on the salivary glands, and that, independently of the sore-mouth, it would promote their secretion in a greater degree than any other except the hepatic; but there is as little doubt that the existence of the stomatitis adds very greatly to its efficiency in this respect, through the well-established physiolo-

gical law, that a gland is stimulated by any irritation of the tissue near which its secretory duct opens.

But probably the most important alterative influence of mercury is exerted upon the ultimate organic constituents of the tissues, on which it may be supposed to act as upon the living constituents of the blood, hastening their disintegration, and thus revolutionizing in some degree all the working parts of the system, through the removal of the old, and the substitution of new structure. That it has such an operation, is proved by the rapid emaciation which takes place during mercurialization. The effete matters resulting from this disintegration are thrown into the blood, whence they escape by the excretory outlets. Hence in part probably the foreign fetid matter in the blood, and the stimulant influence on the glands whereby it is eliminated. Hence, moreover, the loaded state of the saliva, which, from the analyses given by Simon, contains an increase of solid ingredients over the normal proportion.

In general there is reason to believe that mercury is rapidly eliminated from the system, which seems to be less tolerant of its presence than of most of the other metals. Thus, Orfila states that, in his experiments on animals with different metallic salts, he has found that, after they had been administered for some time, while lead, copper, and silver could be detected in the tissues at the end of six or eight months from the date of their omission, mercury had generally disappeared in eight or ten days, and had been found only in one instance so late as the eighteenth day. (*London Med. Times and Gaz.*, March, 1852, p. 279.)

But this elimination seems to be not always complete. Reference has already been made to the fact, that mercurialization has come on, in some instances, to all appearance at least, long after any mercury had been taken into the system. It is possible that, in the change of tissue which takes place under its influence while circulating in the blood, there may be matters produced, or set free, capable of forming with the mercury a compound insoluble in that fluid; or chemical reagencies may be brought into existence which may serve to reduce the metal; in either case, the insoluble mercurial is deposited in the tissue, and must remain until some influence is brought to bear upon it, capable of effecting its re-solution. Hence, possibly, the metallic mercury which is asserted to have been found in the brain and elsewhere. Confirmation of this view is afforded by the observations of Mialhe, Melsens, and others. Thus, Mialhe has shown that, in the presence of an oxygenizing

agent, and one of the alkaline chlorides, mercury, in the metallic state, or any of its ordinary insoluble combinations, becomes soluble in the blood; and, according to the experiments of Melsens, iodide of potassium has the similar property of rendering the mercurials soluble. Hence, it is only necessary to suppose that a sufficient excess of one of the alkaline chlorides should, under favourable circumstances for oxidation, be present in the blood, in order to effect a solution of the deposited metal, and thus, detaching it from the tissues, to bring it into the circulation, once more capable of exercising its peculiar influence on the system at large: and it would seem, from the experiments of M. Melsens, that iodide of potassium, given largely, and absorbed freely as it certainly is, ought to produce the same effect. Some observations made by Dr. Wm. Budd afford still further confirmation. In one instance, a patient who had taken mercury largely, but none for five months, was put on the free use of iodide of potassium, and in a few days was profusely salivated, with all the characteristic phenomena of mercurialism. The mercury was probably set free by the iodide of potassium, and thus made capable of acting: and Dr. Budd states that he has seen many other cases of exactly the same kind. (See *Brit. and For. Med.-Chir. Rev.*, Jan. 1853, Am. ed., p. 158.)

The occasional cumulative action of mercury may be explained on a somewhat similar principle. The metal itself, and its insoluble compounds, can act, after entering the stomach and bowels, only by becoming soluble there. Ordinarily, there is enough of one of the alkaline chlorides present to effect this object, and ordinarily, therefore, they operate. But, if this should not be the case, they may remain inert until, from some change of diet, or other cause, the materials requisite for the due chemical reaction may become present, and absorption and consequent mercurialization may take place. Whether it is the alkaline chlorides, or some other agent that operates, the result may be the same; and we are thus offered a satisfactory theoretical explanation of a phenomenon, otherwise but very vaguely understood.

3. *Therapeutic Application.*

It will be most convenient to treat of the remedial uses of mercury, as its physiological effects have already been treated of, first in reference to its insensible or proper alterative action, and secondly to the influences it exerts in the state of full mercurialism.

a. *Uses in Reference to its Insensible Operation.*

It will be remembered that the influence of mercury, when given so as to produce no observable effect on the system, is exerted chiefly on the hepatic function; and the cause of this preference has been explained. It is with a view almost exclusively to its alterative action on the liver, that the medicine is used in this way. But, notwithstanding this limitation, it will be found that the varieties of morbid condition are not few, in which it proves highly serviceable. The immediate aim is to stimulate and regulate the hepatic secretion; but there are so many affections, which either have their roots in disorder of this function, or are greatly aggravated by it, that the curative effects of the remedy are greatly diversified. Besides, even when the liver itself is not in fault, the increase of its function may operate beneficially by depleting from the portal circulation, and thereby relieving congestion and irritation of all the abdominal viscera which are embraced in this circulation. The secretion of bile may be deficient, deranged, or excessive.

1. *Deficient secretion* is indicated either by scanty, hard, and dry stools, in which, though the bile is sufficient to give colour to the passages, its whole quantity is very small, or by an absence, more or less complete, of the bilious colouring matter. Several morbid conditions are connected with this state of the passages.

A slight degree of it may be attended simply with *constipation*. The bowels act sluggishly, because defectively supplied with the bile, which is one of their normal stimulants. In a higher degree, it induces a condition sometimes considered as a phase of *dyspepsia*, sometimes rather indefinitely called *bilious disorder*, which is marked by epigastric uneasiness, feelings of vague abdominal discomfort, often colicy pains, defective appetite, slight fur on the tongue, perhaps some sallowness of the face, and more or less mental inertness, depression of spirits, or even intellectual aberration. *Jaundice* is a still higher stage of the same disorder. In this affection, the secretion of bile has ceased, the stools are clay-coloured, and the yellow colouring matter of the bile, not escaping by the regular emunctory, accumulates in the blood, and is thrown off in the urine, upon the skin, and everywhere through the tissues. All the above disorders are grades of the same affection, which has its foundation in torpidity of the liver; and the remedy is to stimulate that organ to increased secretion. From two to eight grains of the blue mass,

or from half a grain to two grains of calomel, given every day or every other day at bedtime, and followed next morning before breakfast by a gentle laxative, will very generally restore the proper colour to the passages, and remove the disorder. In the slightest cases, the cure is often effected by one or two repetitions of the smallest dose; in the severer and more lasting, it may be necessary to persevere with the larger doses for a long time, and even to call in the aid of other measures. A severe and obstinate attack of jaundice may, I believe, often be averted by directing attention to the stools in cases of slight digestive derangement, and, upon finding them deficient in colouring matter, resorting to the alterative mercurial treatment here pointed out.

In another set of complaints, instead of constipation there is looseness of the bowels; and the passages consist of liquid matters, sometimes but slightly tinged with bile, sometimes wholly destitute of it, and resembling oatmeal gruel in appearance. Hence arises a not unfrequent variety of *diarrhœa;* and I have occasionally seen our *endemic cholera* take on the same character; the discharges being nearly colourless. Under these circumstances, either from torpor of the liver, or active congestion of the organ interfering with its function, the portal blood is not carried through it with the ordinary rapidity, and consequently accumulates in the blood-vessels of the stomach and bowels, which relieve themselves by excessive secretion of serous or muco-serous liquid. The evacuations are sometimes so copious from this cause as to involve life in danger. In a higher state of the congestion, or a peculiar condition of the blood, the vessels relieve themselves by a sort of hemorrhagic exhalation; the blood oozing from extensive portions of the surface, and mixing intimately with the mucus, so as to produce copious black, tar-like passages. This is *melæna.* All these conditions, the *diarrhœa*, namely, the *cholera*, and the *melæna*, may be happily treated by the alterative use of mercury, in a manner somewhat different from that above recommended. From the irritable state of the alimentary canal, the doses suitable in constipation might endanger an increase of the irritation. Very small doses frequently repeated, and combined with small doses of opium, are now indicated. One-sixth of a grain of calomel with one-eighth of a grain of opium, may be given every half hour, hour, or two hours, according to the urgency of the case; and, if a speedy checking of the discharge be deemed essential, a grain of acetate of lead may be added to each dose. These doses should be con-

tinued until some impression is made on the disease, and then given at gradually lengthening intervals, until it ceases; care being taken not to push the medicine so far as to cause salivation. Sometimes it will be found useful to give the mercurial on this plan only every other day, leaving the patient without medicine, or at least without the mercurial on the intervening day.

In *cholera infantum*, and the *diarrhœa of young children*, deficient secretion of bile is an exceedingly common element, and calls for the same treatment. In these cases, the dose of calomel may often be reduced with propriety to one-twelfth of a grain, or even less, every hour, especially when there is vomiting at the same time with purging. Not unfrequently there is excess of acid in the primæ viæ, evinced either by the sour smell, or greenish colour of the intestinal discharges. Here the blue pill or mercury with chalk may be substituted for the calomel; the former being associated with prepared chalk or oyster shell, in cretaceous mixtures. One-quarter of a grain of the blue pill, or a grain of the mercury with chalk, may be given every hour or two, until bile is sufficiently restored to the passages. In order to make a more rapid impression, the late Dr. Physick was in the habit of treating the bowel complaints of children, over two years of age, with much larger doses of calomel, giving two grains every two hours until the disease was checked. I have occasionally imitated the practice, with the effect of promptly arresting the discharges; but the doses should not be repeated more than three or four times, on any one occasion.

In the *diarrhœa which precedes epidemic cholera*, the same absence of bile in the passages may often be noticed, and should be treated, in the same way, with the minute doses of calomel and opium frequently repeated. A more energetic use of the same remedy is, I believe, indicated in the earlier stages of the *fully formed cholera*, in which the utter want of biliary secretion is one of the most prominent symptoms, and its return one of the most favourable signs. The combination of calomel, opium, and acetate of lead, which I had long used habitually in the profuse colourless diarrhœa above mentioned, I was induced to resort to, upon a larger scale, in the first cases of cholera which occurred to me, and had every reason to be satisfied with my success. In this complaint, it is important to make an immediate impression. Instead, therefore, of the very minute doses given in the less rapid and dangerous affection, I prescribe half a grain or a grain of opium, a

grain or two of calomel, and from two to four grains of acetate of lead, at the first dose, and repeat the combination every half hour or hour afterwards, in one-quarter or one-half the quantity, until some impression has been made on the disease; a large sinapism being at the same time applied to the abdomen, and an anodyne enema administered.

Not unfrequently this deficiency of bile in the passages is associated, as an accidental accompaniment, with other diseases. Whenever it so happens, there is the same indication for the alterative use of mercury; and calomel, or some other mercurial, should be associated with other remedies in the treatment. This indication is often afforded in the course of the *idiopathic fevers*, and various *phlegmasiæ*, and the same rule as to the regulation of the dose may be observed as in the former cases; that is, if there is a tendency to irritation of stomach and bowels, the medicine may be given in small and often repeated doses; otherwise, in a larger dose at bedtime. I am very much in the habit, under the latter circumstances, of associating from one to three grains of calomel, with the opium and ipecacuanha, often indicated to procure rest at night. In *dysentery*, in which the secretion of the liver is often diminished, this treatment is prominently indicated, even when there may be no intention to exhibit the calomel with reference to its antiphlogistic influence.

2. Instead of simple deficiency of bile, there is often a *perverted secretion*, as shown by the altered colour of the passages, which are now *dark-coloured*, *brown*, or *black*, and sometimes acrid, causing much uneasiness in the bowels. The colour may be distinguished from that of hemorrhage by the absence of any shade of redness when the stools are diluted. I have repeatedly noticed that this darkness of the stools is the first step towards their decolorization: implying that the action of the liver is deranged before being suspended; and a very gentle interference by mercury, under these circumstances, is often sufficient to correct the disorder. As in the preceding condition of the secretion, there may be attendant upon this either a constipated or loose state of the bowels; in the latter case, forming a disease which has often been confounded with true melæna. The treatment is exactly the same as for deficient bile; the larger dose at bedtime being given in the cases with torpid bowels; the smaller doses, distributed at short intervals through the day, in those attended with diarrhœa.

3. Singular as it may seem, an *excessive secretion of bile* by the

liver will generally yield with great facility to the same treatment, proving that it is not merely a stimulant influence which the mercury exerts on the liver, but that its action is really alterative. In *cholera morbus* and *bilious diarrhœa*, both characterized by excessive discharges of bile, the treatment which in my hands has always acted most kindly, is that of the small doses of calomel and opium, repeated at very short intervals, as above described. In cholera morbus, after the stomach has been washed out by free draughts of chicken water, or some other demulcent beverage, let one-sixth of a grain, each, of calomel and opium be given every half hour, while a strong sinapism is applied over the abdomen, and the disease will, I think, be generally found to yield speedily. If any one be disposed to smile at the minuteness of these doses, let him try the plan, and afterwards decide as to its efficiency.

The foregoing are the chief uses of the mercurials, so administered as to produce no other observable effect, than alteration from a morbid to a healthy state in the hepatic and digestive functions. That they may be beneficial, in the same doses, in those affections in which they are ordinarily exhibited so as to produce ptyalism, is highly probable; nay almost certain; as we constantly witness the desired result, though they may fall short of salivating, as they often do, when given with that object. They are, indeed, not unfrequently administered purposely in such affections in alterative doses; but it would be waste of space to enumerate such applications of the remedy under this head; as they are to be considered immediately in connexion with its sialagogue operation.

b. *Therapeutic Application Connected with full Mercurialism.*

The uses to which mercury may be applied, in this relation, may be arranged under 1. its sialagogue property, 2. its property of stimulating the secretions, 3. that of promoting absorption, 4. its general stimulant property, and 5. that of changing the condition of the blood and the tissues, which may be designated as its revolutionizing property, under which may be ranked its antiphlogistic, febrifuge, and antisyphilitic effects.

1. *Uses in Reference to the Sialagogue Effect.*

Mercury is now no longer given purposely for its effects on the mouth and salivary glands. These are considered only as signs of its influence on the system; and the aim is always to produce as little of them as possible, compatible with other objects. Nevertheless, there is no doubt that they are in themselves often, to a certain

extent, serviceable in disease; so that, when they are accidentally or unavoidably carried beyond the degree considered desirable, they are by no means always an unmitigated evil. It is even highly probable, that a much more profound influence is sometimes exerted upon disease by that amount of general mercurialization which is marked by severe ptyalism, than by that attendant upon the mere touching of the mouth. The ptyalism itself operates advantageously in two modes; by revulsion, namely, and by depletion. In both these methods it serves to relieve inflammation of the neighbouring parts, as of the brain, eyes, ears, and air-passages. The amount of saliva lost must sometimes act with considerable depletory effect upon the system at large, and thus prove serviceable in inflammations more remotely seated. Sixteen pounds are said to have been secreted in twenty-four hours; and, as the saliva of mercurialism contains a considerable proportion of organic matter, there must have been, in such a case, very considerable loss to the system. But, by almost universal consent, the good resulting, in either mode, from excessive ptyalism, is considered insufficient to outweigh the positive sufferings and possible evils which may result from it; and a practitioner is scarcely thought justifiable, either in aiming to produce it, or in not taking all proper precautions to restrain it within proper limits, when he may deem that he is bound to run the risk of its occurrence.

2. *Uses in Reference to the Stimulation of the Secretions.*

This effect of the mercurials may often be taken advantage of therapeutically with great effect. A condition of the system not unfrequently exists in *febrile diseases*, in which the secretions generally are deficient. The skin is dry, the mouth is dry, the urine is scanty, and the bowels, when not affected with inflammation or ulceration, are constipated from a deficiency of the intestinal secretions, including the mucous, hepatic, and probably the pancreatic. Under these circumstances, no matter what may be the special disease, a gentle mercurial influence seems to be indicated, and, according to my experience, often proves serviceable. It should be brought about by the mildest and least irritant measures. I generally prefer for the purpose the mercurial pill or blue mass, which may be given in the dose of one grain every two hours, until the slightest sign of its action upon the mouth is observable, when the dose should be given at longer intervals, so as simply to maintain the degree of effect produced. The mercurial may often be usefully associated, in these cases, with a little ipeca-

cuanha, say one-sixth of a grain to each pill, when it is specially desirable to promote perspiration, and a little opium also, when that medicine may happen to be indicated.

To promote the several secretions, mercury is not often given by itself, except in reference to the hepatic; but, whenever it is desirable to stimulate this function, it affords, beyond all comparison, the most efficient means. I have already treated of its use in this respect in the simple alterative doses, which, without seeming to produce much effect on the organ in health, have a remarkable power of restoring its function, when torpid or deranged from disease. But it frequently happens that a more powerful impression is required, such as may produce an obvious effect, either by purgation, through the quantity of bile secreted, or by the constitutional action of the medicine. There is a certain degree of incompatibility between these effects of the mercurials. When given in large doses so as powerfully to stimulate the liver, the medicine is apt to be carried off with the bile secreted, before it can reach the general system, so that this often escapes entirely. More will be said on this subject when we come to consider calomel as a purgative. So far as the hepatic secretion alone is concerned, this result is rather desirable than otherwise; as the end desired is obtained without the inconvenience of a sore-mouth. Hence this indication is often better met with full purgative doses of calomel, than by such an administration of it as may induce mercurialism. But not unfrequently there is a joint indication for the latter effect, and for stimulation of the hepatic function; and, in such cases, the medicine must be given in reference to both purposes, either by dividing the doses, or adding opium in order in some degree to control the purgative tendency.

Jaundice, which, as before stated, will often yield to the simple alterative influence of mercury, sometimes requires that the medicine should be carried to the point of salivation before it will yield.

Bilious colic, in which there is often great congestion of the liver, with repressed secretion, is most effectively treated with calomel and opium, which may often be advantageously carried to a slight ptyalism. Two grains of opium and from four to six grains of calomel may be given at once, to be followed, at the end of an hour, if the patient is not relieved, by half the dose, and in another hour, under the same circumstances, by another half; after which, a dose of sulphate of magnesia, or of infusion of senna with the same salt,

may be given, and repeated at proper intervals until the bowels are opened.

Dysentery is another disease, in which calomel may be very usefully given with the view of promoting the biliary secretion; and the same may be said of the *bilious remittent* and *yellow fevers;* but, in these complaints, it is also employed in fulfilment of other indications to be mentioned hereafter.

In fact, in all diseases whatever, in which the liver refuses to act, whether from torpor, or excessive irritation with active congestion, the mercurials generally, and especially calomel, are strongly indicated; not only in order to restore the bilious matter to the bowels, which require it as one of their necessary stimulants, but also to eliminate from the blood effete matters, which might otherwise exercise an injurious influence on the system.

In all the cases in which the object is specially to affect the *secretion* of the liver, the medicine should be given by the mouth; as, being absorbed into the portal veins, it is thus carried directly to the seat of the secretory function, and exercises its full influence on that function. If intended to affect the organization of the viscus, as in hepatitis, it would no doubt act efficiently if absorbed from the surface of the body; for it then enters the general circulation, and ultimately reaches the liver by the hepatic artery, through which it is brought into direct relation with the ultimate structure, as engaged in the process of nutrition.

On the *skin* and *mucous* membranes, it is probable that mercury operates beneficially by stimulating their secretory function, and maintaining them in that soft or moist state which is essential to their healthy condition. Its usefulness in chronic cutaneous eruptions, and chronic inflamed states of the mucous membranes, may be explained in part in this way; but it probably depends more upon the revolutionizing antiphlogistic effect of mercury, which will be treated of directly.

In consequence of its general property of increasing the secretions, mercury is not unfrequently prescribed in connexion with medicines addressed to the several secretory functions, in the hope that its general influence may thus receive a special direction. Thus, with the diaphoretics it is supposed to be directed specially to the skin, with the expectorants to the lungs, with the diuretics to the kidneys, and with the emmenagogues to the uterus. I am not quite sure, though I have often used mercury in such combination, that I have witnessed very decidedly the effects referred to.

Nothing is more certain than that the combination often answers an excellent therapeutic purpose. Thus squill, aided by mercury, is much more efficient in curing dropsical diseases of the chest, than without such aid; and bronchitis will yield to mercury and the expectorants jointly, when it may refuse to yield to the latter medicines exclusively. But it is probable that the mercury in these, and in all other analogous cases, acts therapeutically much more by a direct alterative influence on the diseased tissue, than through any increase of secretion which it produces. Except as regards the hepatic and salivary secretions, although the medicine may produce a slight effect upon all the secretory functions as a general rule, and may occasionally excite some one of them specially, as that of the skin or kidneys, I do not think it can be depended on remedially in any one of them; and I am not therefore prepared to join in recommending it as an adjuvant to other medicines upon this ground alone. I do not think that, as a general rule, it renders Dover's powder more diaphoretic, digitalis more diuretic, or seneka more expectorant, in any sensible degree.

3. *Uses in Reference to the Promotion of Absorption.*

There is not, I think, any sufficient proof that mercury directly promotes the absorption of effused liquids. So far as it increases secretion, and thus lessens the volume of the blood, it may indirectly produce the effect; and may, therefore, in cases of excessive ptyalism or biliary evacuations from its use, have sometimes operated beneficially upon this principle; but assuredly no one would aim at producing absorption through such an agency. Although, therefore, mercury has been recommended in *dropsy* upon this ground, and has been much used in that disease, I do not think that it is calculated to be of any service whatever, so far as the mere absorption of the effused liquid is concerned. It has indeed been too indiscriminately employed in that affection; and has sometimes acted very injuriously by impairing the state of the blood, or otherwise debilitating, in cases where influences of a directly contrary character were all important. In the dropsy of pure anaemia, and that dependent on fatty degeneration of the kidneys, it can do only harm. But there are undoubtedly cases of this affection in which it is extremely useful, not to say indispensable; and it is, therefore, of the greatest importance to make a proper discrimination. The varieties of dropsy to which it is adapted will be mentioned in another place. All that I wish to

call attention to here, is that it should not be used indiscriminately in the affection, on account of any supposed property of favouring the absorption of effused liquids.

But mercury is very useful by promoting absorption in another way. It has long enjoyed great credit as a *deobstruent*, in resolving and dispersing chronic indurations and tumefactions of various kinds, such as enlarged glands, thickened ligaments, osseous swellings, inflammations, hardenings, and hypertrophy of the different tissues. So far as still existing inflammation has anything to do with these conditions, mercury may be supposed to act simply through its antiphlogistic property. But it proves useful when all signs of inflammation have disappeared, and sometimes, perhaps, when there is no proof that it has ever existed. It seems in these cases to exercise a direct power of absorption. The effect may be explained without difficulty, in accordance with the views already given of the action of mercury. One of its most energetic properties is that of promoting disintegration of the tissues. It may be readily conceived to exert this property, with greater relative effect, on structures having little vital power of resistance, than on those which are quite healthy. If this be the case, swellings and indurations of the kind referred to, having comparatively feeble vital force, yield to the disintegrating influence with greater facility, and are consequently diminished more rapidly than the structure around them. Of course, the debris of the tissues are carried off by the absorbents or veins, and absorption seems to have been promoted; the fact, however, being, that this function is stimulated by the effete matters of the decomposed structures, and not that the structures disappear through increased activity of absorption.

As an example of the good effects which may be expected from this property of mercury, beyond the mere removal of the tumefaction, may be adduced the relief of serious organic affections of the heart. In consequence of the organization of the fibrinous exudation of endocarditis, thickening of the valves, and excrescences upon their surface are apt to remain, either impeding the onward flow of the blood, or, through imperfect closure of the valves, giving rise to regurgitation. Hence hypertrophy and dilatation of the heart, congestion and consequent disease of the great viscera, and ultimately universal dropsy. In such cases, indicated by abnormal sounds of the heart, if treatment be commenced before serious mischief has been accomplished, there is reason to hope

that a moderate but steady course of mercury may prove of great service, by causing a removal of the offending cause.

In all cases of external hardening and tumefaction, the mercury may be used both internally, and by friction with the ointment or the application of the mercurial plaster, externally; the topical use of it being so directed, that the absorbed medicine may be made to pass into the abnormal structure.

4. *Uses in Reference to General Stimulation.*

It has been stated that the circulation is stimulated during mercurialization. The nervous centres are probably similarly excited. Even the disintegrating property is perhaps only the result of an excitant influence directed to the nutritive process. Mercury may, therefore, be regarded as a universal excitant of the tissues. On this account, it may be used advantageously in certain cases of debility, in which there may be no reason to fear its influence on the blood. Experience has shown that, in the typhoid state, the blood does not materially suffer under the use of the medicine; and there would seem to be, in some unknown way, an opposition between the influences of these two agencies, namely, mercury and the typhoid condition, upon the circulating fluid. Consequently, in febrile and inflammatory diseases which are disposed to fall into the typhoid state, mercury is useful as an excitant, while, as will be seen hereafter, it often serves a most excellent purpose by the possession of other powers.

5. *Uses of Mercury as a Revolutionizing Agent.*

There is a wide circle of diseases, in which mercury has been proved by abundant experience to be useful, and in which its beneficial effects cannot be referred entirely to any of the obvious therapeutic modes of action hitherto noticed, or to any combination of them. A partial explanation has been sought in the rather vague dogma, that the metal exercises a revolutionizing influence; substituting a morbid state of its own creation for that previously existing, and, having thus subverted the disease against which it may have been directed, spontaneously retiring after a time, and yielding the system, in a sound state, to the government of its own legitimate vital forces. It will be readily perceived that this explanation consists of little more than words, and absolutely explains nothing. We may advance a step further in the solution of the problem. It has been already stated, more than once, that mercury has the property of promoting the disintegration of the tissues; in other words, of stimulating that part of the process of nutrition

which consists in the removal of the old structure, without in a corresponding degree promoting that other part of it, the business of which is to replace the loss. It may be supposed to produce this effect by causing, through its presence in the blood, a more rapid oxidation of the ultimate constituents of the tissues. But, whatever may be the mode of operation, the effect may be conceived to be, a removal of the old structure in which the previously existing disease was seated, and a substitution of new structure, stamped with its own readily effaceable characters. The morbid processes which mercury has thus shown itself capable of subverting are, among others, inflammation, syphilis, and perhaps fever.

a. ANTIPHLOGISTIC ACTION.—After blood-letting, there is probably no remedy more powerfully antiphlogistic than mercury. It is not upon any theoretical grounds that this opinion, so generally received among medical men, was formed, or is maintained. It rests solely upon observation. Mercury is administered; and, as soon as the sore-mouth, indicating its effects on the system, is perceived, an amendment of the disease often begins to take place; and there is a regular advance towards health, under the continued influence of the remedy. This has been so often seen, and so often continues to be seen, in the daily experience of practitioners, that nothing but a strong prepossession can resist the weight of evidence, in proof of the extraordinary antiphlogistic powers of the medicine. There are some, however, who, admitting its powers, are deterred from using it by their fears. It cannot be denied that mercury is capable of doing much harm if abused; but of what powerful medicine cannot this be said. We are indebted for much of the odium which rests upon it, in the popular mind, and of which empirics are ever ready to take an unprincipled advantage, to the reckless abuse of it in the hands of careless and ignorant practitioners, and to a want of caution in its use, of which even the most enlightened among our predecessors were not altogether guiltless. Now that the properties of the medicine are better understood, it is wholly unnecessary to incur the risk of those evils which were formerly but too frequent; at least, the cases are extremely few, in which, if judiciously used, it will inflict any serious or lasting injury. I have been in the habit of prescribing mercury now for nearly forty years, and must have administered it during that period, in public and private practice, to some thousands of persons; yet I can conscientiously state that I have not seen a single case, in my own practice, in which I was

satisfied that the remedy left any permanent ill effect behind it, unless perhaps a more rapid decay of the teeth in a few instances; and I have never witnessed an instance of fatal result. I am fully convinced that it may be used as safely as any other very efficient remedy; and even more safely than many which might be mentioned, and which are given habitually by persons who profess an abhorrence for mercurials.*

As to the method in which mercury acts as an antiphlogistic, something may possibly be ascribed to the increase of the secretions; but this is much too slight to be the chief cause of its favourable effects, which probably depend mainly on the change in the tissues above referred to, and its influence on the blood. Some attribute the effects chiefly, if not exclusively, to the latter cause; the blood being, as they suppose, rendered less capable of supplying matter of exudation to the inflammatory process, and peculiarly indisposed to the formation of false membrane. It is to cases of pseudomembranous inflammation, that they conceive it peculiarly applicable, in consequence of its remarkable antiplastic property. But I entertain strong doubts upon this point. The blood during ptyalism is apt to exhibit the buffy coat; and every one has seen, as a consequence of severe mercurial stomatitis, abundant exudation of matter, bearing at least a close resemblance to false membrane. Besides, in the treatment of serous inflammation, as of the pleura, pericardium, and peritoneum, though the disease may be subdued, we discover no tendency to a disturbance of the process by which the exuded fibrin undergoes organization, as union between the opposing surfaces is effected. Nor is the efficiency of the medicine, according to my experience, best displayed in cases of plastic inflammation. I am quite sure that bronchitis and mucous enteritis, yield to it with quite as great facility as pleurisy or peritonitis. If its antiplastic property were its chief recommendation, we should find it rather injurious than beneficial in the inflammation of typhoid diseases; whilst, in my experience, it is in these affections that it displays its best antiphlogistic powers. I believe that these powers depend less on its influence upon the blood, than on the change it produces in the solids; in other words, upon a

* Not less than eight cases of death are recorded in one of the London journals, as having occurred within a short time, in England, from the use of lobelia by a class of practitioners, who exclaim against mercury as a poison; yet in looking over many journals for years, I have for a long time, to the best of my recollection, met with no recorded instance of death from mercury.

revolutionizing or substituting property, which unseats existing diseased action, probably by disintegrating the tissue in which it is seated, and establishes its own, by replacing the removed structure with a new one from the mercurialized blood. That it produces inflammation in the mouth, is no proof that it cannot cure ordinary inflammation. The stomatitis of mercury is peculiar, and I have no doubt that a pre-existing obstinate inflammation of the ordinary kind, occupying the same parts, would be found, upon the subsidence of the mercurial, to have been displaced by it. The great advantage of the mercury is, that the specific disordered state which supersedes the disordered state pre-existing, whether it amount to inflammation, as in the mouth, or to a mere gentle excitement of the function, as in most of the organs, quickly subsides upon the removal of the cause, and leaves a normal, though possibly a somewhat debilitated condition behind it.

Mercury, however, should not be used in all cases, or under all circumstances of inflammation. Except in hepatic affections, I never use it when the disease is slight, temporary, and readily curable; nor, indeed, in severe or chronic cases, when I have reason to think that they will yield readily to the ordinary antiphlogistic treatment. In the highest stage of excitement, during the first few days of the disease, it is not usually indicated. It does not so readily affect the system, probably because absorbed with more difficulty; and, if it succeed in making the mouth sore, does not seem to possess the same power of subverting the morbid action as at a later period, while it adds its own general excitation to that of the existing disease. It is best, therefore, in common vigorous inflammations, to employ first the ordinary antiphlogistic measures, as bleeding, purging, the antimonials, local bleeding, the warm bath, low diet, &c. In very many instances, these will be found sufficient for the cure. Not unfrequently, in the progress of this treatment, when opium at night becomes admissible, I administer, with this narcotic and ipecacuanha, from one to three grains of calomel each evening at bedtime, with a view partly to a more ready mercurialization, should that become necessary, and partly to a slight alterative influence, which may tend to sustain the hepatic function, render the bowels more soluble, and exercise a gentle excitation of the secretions generally. But, should the disease not have assumed a favourable aspect, and should it appear in any degree threatening about the fourth or fifth day, I then give the mercurial with a view to its full effects upon the system, regulating the dose and the frequency of

repetition, in accordance with the degree of supposed danger. In general, from four to twelve grains of calomel in the twenty-four hours are sufficient, which, when opium and ipecacuanha are not contraindicated, may generally be given in combination with one or both of these medicines, so as to obviate purgation, give a tendency to the skin, and add in other respects to the comfort of the patient. In very urgent cases, the mercurial may be increased; but more than a grain every hour, upon an average, can very seldom be given with benefit, as even this quantity is more than is likely to be absorbed.

In cases, however, of *typhoid inflammation*, or others of an asthenic character, in which depletion by the lancet may be forbidden, I commence, immediately after purgation, with the use of mercurials, with the view to salivation, combining with them whatever other medicines circumstances may seem to require. But, in such cases, a smaller amount of the medicine is required daily; and the blue mass may often be usefully substituted for the calomel, as milder and less apt to disturb the bowels.

There are other special inflammations in which, from their rapid course or great danger, or from the peculiar facility with which they yield to mercury, this medicine should be used from the outset, though they may exhibit no tendency whatever to the typhoid character. To this category belong *endopericarditis*, *peritonitis*, *severe submucous* and *pseudomembranous laryngitis*, *pseudomembranous croup*, *hepatitis*, and *iritis;* and perhaps *meningitis* may be added to the list. In these affections, when severe, immediately after the first bleeding, a cathartic consisting of calomel, wholly or in part, should be administered, and this should be immediately followed by smaller doses of calomel or blue mass, given at such intervals as to bring the system as quickly under the mercurial influence, as may be consistent with a prudent caution against excessive salivation. The quantity administered, during the day, may be the same as before recommended for acute inflammation in general; and, as in that, the mercurial should be associated with opium and ipecacuanha, when these are not contraindicated.

To *pseudomembranous croup*, *hepatitis*, and *iritis* the above remarks are peculiarly applicable. The first of these affections is so frequently, and so speedily fatal, unless the progress of the exudation can be checked, the second, when severe, is so apt to end in a disorganizing suppuration, and the third so much endangers the inte-

grity of vision, that as speedy an impression as possible should be made by the mercurial.

In *pseudomembranous croup*, from the moment that its nature has been ascertained, the mercurial plan should be commenced. After a purgative dose of calomel, one-quarter or one-half a grain may be given, every half hour or hour, until the desired effect is produced, or the remedy can obviously be no longer of use. It acts by subverting the inflammatory process, and thus preventing the further exudation of coagulable lymph from the membrane, which now secretes mucus, and thus produces a separation of the fibrinous layer, and facilitates its expulsion by energetic emetics. The doses above mentioned are preferable to larger; as they will be less apt to purge, and consequently more liable to be absorbed, which is the object desired. The enormous doses which have sometimes been given probably defeat their own end. If they do not purge, much the larger proportion must lie inert in the bowels.

In *iritis*, mercury is an almost certain remedy, if used in time, not only when the disease is of syphilitic origin, but also in cases originating in the ordinary causes of inflammation. It should be given immediately, and steadily persevered with to salivation; but not to the exclusion of other antiphlogistic measures.

Hepatitis is probably the special inflammation in which mercury shows its most extraordinary antiphlogistic powers. With due depletion, and early employed, it is an almost certain remedy in the acute form of the disease, as it occurs in this climate.

In *chronic inflammations*, which have resisted the ordinary antiphlogistic method, mercury should be employed without hesitation; and will often be found to produce the most prompt and happy effects. Diseases of this kind, after a duration of months, will not unfrequently enter into an immediate course of amendment upon the establishment of the mercurial influence, though a considerable time may be required for effecting a complete cure. In these, it will often be sufficient to commence with from half a grain to a grain of calomel, or from two to five grains of the blue mass, three times a day; the dose being increased, if no observable effect is produced, in a few days. It is highly desirable not to bring about too powerful an effect on the mouth, as the patient thus becomes disgusted with the remedy, and it may be impossible to persevere with it a sufficient length of time to effect a complete cure. The neglect of this caution is probably one of the most frequent causes of failure with mercury in chronic diseases. It has already been

said that, from the experiments of Orfila, it may be concluded that mercury is usually expelled from the system very quickly; no evidence of its presence being discoverable, as a general rule, after eight or ten days. (See *page* 245.) This is too short a period for the complete subversion of a fixed chronic disease. Hence, when the local effect is so violent as to necessitate the suspension of the medicine, it is all eliminated before it has produced the desired effect; and the disease, if moderated for a time, is not eradicated, and may afterwards resume all its original activity. In order thoroughly to cure certain chronic inflammations, it is advisable to sustain a moderate influence of the mercurial, not only for weeks, but sometimes for several months. This remark is strongly applicable to *chronic hepatitis*, in which mercury is by far the most efficient remedy, but in which it has often failed, I believe, from being too urgently pressed at first. As chronic hepatitis occurs with us, when not already advanced to suppuration, it almost invariably yields to a carefully managed mercurialization, sufficiently long continued, and aided by the usual measures. Blue pill is here preferable to calomel, and should be so given as to produce only the slightest effect on the gums, simply sufficient to indicate that it is acting.

It would be superfluous to designate specially every inflammatory affection in which mercury may be used. So far as the mere inflammation is concerned, there is no exception to the general rule. There are contraindications offered by the state of the blood, or the special vice of the system in certain diseases, which forbid the use of the medicine, even though called for by the local affection; but, so far as the inflammation itself is concerned, I believe that it is always indicated. These contraindications will be noticed hereafter.

The inflammations which may be considered as specific, generally yield to the remedy, with not less facility than the phlegmonous.

In *acute rheumatism*, after due depletion, mercurialization will in general, according to my experience, either at once put an end to the disease, or very favourably modify its course. The plan which I have usually pursued in this complaint is to treat the case for the first week or ten days by bleeding, purging, the antimonials, and Dover's powder, with which a little calomel is given at bedtime; and if, at the end of this time, the disease should not have yielded, to give two or three grains of calomel with ten of Dover's powder, every eight, six, or four hours, or smaller doses at shorter

intervals, until a decided impression is made on the mouth: then to diminish the mercurial, but without allowing the effect to subside until the disease is cured, or the plan altogether abandoned. In *chronic rheumatism* there is, I believe, no one remedy comparable in efficiency with mercury, carried to a decided impression, and continued for a considerable time. To the *subacute* and *nervous variety* the medicine is less adapted; to the former, because the disease in general readily yields to other measures: to the latter, because there is no inflammation to encounter.

In *erysipelas*, when indisposed to yield to the ordinary measures, I have found mercurialization useful; but it is seldom necessary, as the disease, in ordinary cases, almost always ends favourably without it; and, in the malignant cases, it is not so much the local affection as the state of the blood, or otherwise depraved state of the system, which is the source of danger, and mercury has no favourable influence over the latter conditions.

To *scrofulous inflammation* mercury is generally considered inapplicable; and yet it has often been found effectual, especially when locally used, in dispersing glandular swellings supposed to be of that character. When the inflammation is produced and supported by tubercles, as very often happens, the medicine can be of no use; for it has no curative power whatever over that deposit. But, so far as concerns the pure inflammatory process, occurring in scrofulous patients, without such complication, it is probable that mercury has the same influence as over inflammation in general. There are, however, serious objections to its use: for, admitting that the external non-tuberculous swellings might yield to it, there is great doubt as to the propriety of dispersing such swellings, which may serve as an outlet for tendencies that might otherwise show themselves by tuberculous deposition in the internal organs; and, as will hereafter be more fully stated, mercurialism has anything but a favourable influence over the scrofulous diathesis.

b. Antisyphilitic Action.—Powerful as mercurialization is in ordinary inflammation, it is certainly not less so in the specific inflammation of syphilis. The experience of centuries cannot have been mistaken upon this point. From the first introduction of mercury into general use as an antiphlogistic agent, an almost unbroken voice has come from the past in support of its efficiency. It is only our own age that has doubted. To me it seems utterly impossible that our predecessors for so many ages, men quite as capable of observing as ourselves, should have been mistaken in a mere matter

of fact, such as that now under consideration. Their views may have been, and no doubt often were erroneous; and they were certainly mistaken in their opinion of the exclusive efficacy of mercury in this disease. They erred also in believing that the curative efficiency of the medicine had any relation to its local effects, and greatly erred in the enormous extent to which they often carried it in their blind reliance. But that they generally cured syphilis with it, and that without it the disease was fearfully destructive, I cannot conceive how any one, not altogether distrustful of human testimony, can doubt. To say, that my own observation has coincided with that of our predecessors on this point, can add no weight to their testimony; but each one will necessarily be, in the end, guided by his individual experience, and mine has been such that I cannot but believe in the great efficiency of mercury in syphilis, as firmly as I believe any other fact in medicine. Nor do I believe that any other single known medicine approaches it in antisyphilitic virtues. There is, I think, no stage of the disease in which it cannot be efficiently used, from the first appearance of the chancre, to the last stage of ulceration and cachexia. Though chancres will undoubtedly get well without mercury, yet they will, so far as I can judge from personal observation, yield more readily under its influence; and I have seen the lowest condition of shattered health, which for years had resisted various treatment under the idea that it was mercurial disease, get well under a careful administration of the blue mass, as if cured by a charm. There are, no doubt, depraved states of system occurring in syphilitic patients, as in others, in which mercury proves injurious by further impairing the blood. These will be referred to directly. But in the pure uncomplicated disease, with no taint of scurvy, scrofula, or other depravity besides its own, I have no doubt that mercury is the most reliable remedy in all its states and stages, with the single exception of iodide of potassium in the rheumatic pains, and periosteal swellings, which often linger after the other symptoms.

Nor can I, in any degree, coincide in that opinion which ascribes to mercury effects analogous to those of secondary syphilis. Glandular swellings, ulcerations similar to the venereal in the throat, various eruptions on the skin, cutaneous ulceration, periosteal nodes, and rheumatic pains have been attributed to mercury; and in reading some writers on the subject, one might almost be led to doubt whether secondary syphilis really existed, and to imagine

that what had been mistaken for it was really mercurial disease. It is impossible for me to believe in these supposed effects of mercurials; because, among the thousands to whom I have given the medicine, I have never, in any single instance, seen, as a consequence of it, anything which I could mistake for a venereal affection. It is true that some consider the phenomena referred to as the conjoint effect of mercury and syphilis; the former having called them into operation in persons affected with the latter, when otherwise they might not have appeared. But the source of fallacy is here so obvious, that the strongest proof would be required to establish so strange an hypothesis. A disease exists with a certain train of well-marked and highly characteristic symptoms, which mercury will beyond all controversy occasionally cure. In the healthy system, mercury never produces symptoms which can be mistaken for those of the disease in question. Yet, given to a patient in the early stage of the disease, so far from effecting a cure, it sometimes generates all the subsequent characteristic phenomena, which now take the name of mercurial disease. It seems to me, that only an exceedingly strong prepossession could prevent a well informed man from seeing anything but absurdity in such a statement.

Much of the false opinion in relation to this imaginary mercurial disease, and much of the failure to cure syphilis, have I believe resulted from a cause already referred to (see *pages* 262 and 263); an incautious use, namely, of the medicine, in consequence of which a degree of stomatitis has been induced, which rendered its omission necessary, before there had been time for it to eradicate the disease. The syphilitic symptoms, suppressed for a time, have afterwards returned, and been ascribed to the mercury. If the medicine had been given cautiously, and continued sufficiently long, the disease would have been eradicated, and none of the secondary symptoms would have shown themselves. I once had a case strongly illustrative of this view. The patient had been long affected, and was reduced to the lowest stage of debility, with ulcers, eruptions, &c., which appeared to me obviously of syphilitic origin. I was assured, however, that they were the result of mercury, which had been taken several times, but had always been followed by a return of the symptoms, even in an aggravated form. The patient was extremely susceptible to the influence of mercury, and on each occasion had been severely salivated by a small quantity of the medicine, which was consequently relinquished. I administered the blue mass with extreme caution, and succeeded in producing but a comparatively

slight effect on the mouth, which permitted me to persevere with the medicine for a considerable time. As soon as the mercurial impression was felt, the symptoms of the disease began to decline; and the amendment continued to go on progressively till a perfect cure was accomplished. I saw the patient, from time to time, for a long period afterwards, and thus had an opportunity of knowing that the cure was permanent.

c. Febrifuge Action.—Though mercury has frequently been given in fevers, with the simple view of subverting the disease, we have no reason to suppose that it has any special febrifuge virtue. That it is of great use in certain febrile diseases cannot be denied; but it probably operates simply by correcting some unessential condition associated with the fever, accidentally or otherwise, but which may very much aggravate the disease, and prove the cause of a fatal termination if not obviated. Whenever inflammation attends an idiopathic fever, and refuses to yield to such ordinary antiphlogistic measures as may seem to be indicated, mercury should be resorted to; and there are few diseases of this character which do not sometimes offer occasion for the use of the remedy.

In the *bilious remittent fever*, calomel carried to full mercurialism, is probably, next to sulphate of quinia, the most efficient remedy in violent or obstinate cases. It is indicated by the congested state of the liver, and the frequently defective secretion of that organ; but the chief ground upon which its employment rests, is that of experience; the case seldom terminating unfavourably, when mercurialism has been established. Though now rendered unnecessary, in the vast majority of cases, by the success with which the cinchona alkaloids are employed, yet if these have failed, or from any cause be forbidden, and the case has assumed a threatening character, calomel should be employed with a view to salivation. It may be given in the dose of a grain every two hours till its effects on the mouth are produced, and then diminished or suspended. It is not unfrequently associated with the nitrous powder, when the skin is hot and dry, the pulse strong, and the stomach free from irritation. In the low typhoid state in which the fever sometimes ends, with a dry tongue and scanty secretions generally, I prefer the blue pill, given as will be explained directly in enteric fever.

Yellow Fever affords a strong indication for the use of mercury, in the almost perfect torpidity of the liver, which fails to perform

its functions, at the very time that its action becomes important in order to depurate the blood. It is highly probable that the absorbed poison acts directly on the circulating fluid, causing a rapid disintegration of the red corpuscles, and a consequent excess of yellow colouring matter, which ought to find an outlet through the liver, and, failing of this, gives to the surface the jaundiced hue so characteristic of yellow fever in its second stage. But in this fever, even more strongly than in the bilious remittent, it claims to be employed on the basis of experience. The observation has frequently been made, and the truth of it generally admitted, that whenever mercurial ptyalism can be fairly induced in yellow fever, the patient recovers. Exceptions to the universality of the rule certainly exist, but it is as certainly true to a very great extent. The opponents of mercury maintain that its success is only apparent; as in the violent and fatal cases it fails to salivate, while those in which it produces the effect would recover without it. All admit that, in the worst cases of yellow fever, it is often impossible to induce ptyalism by any amount of the medicine that can be employed, whether internally or externally. But it by no means follows that, when the sialagogue effect can be established, the cure would take place equally without the aid of the mercurial. The argument may be thus stated. As patients almost always get well who come under the influence of mercury, the medicine certainly cannot be accused of producing any serious mischief. It is impossible to say positively, that the recoveries which take place under it are not ascribable at least in part to its influence. If, therefore, it may possibly do great good, and can do no great harm, why not employ it, especially as it is indicated by the state of the hepatic function? Influenced by these considerations, I have no hesitation in recommending the use of mercury. At the very commencement of the disease, from ten to twenty grains may be given as a cathartic, and followed by one or at most two grains every hour, steadily persevered in until it decidedly affects the mouth, or the symptoms of prostration of the second stage forbid its further use. Beyond this quantity, I do not think it desirable to urge the remedy; as, if the system is susceptible, it will be sufficient to effect the object; while much more of it, without increasing the chances of success in due time, may afterwards, if it remain in the system, add very greatly to the inconveniences of the salivation, should this effect be produced.

In *enteric or typhoid fever*, I habitually use mercury in the second

stage, whenever a commencing dryness of the mouth calls for something more than the refrigerant and diaphoretic remedies applicable to the earlier symptoms. There is usually, with this dryness of the mouth, dryness also of the skin, with scantiness of the urine, showing a general deficiency of the secretions. Through the disintegration of the tissues, the blood is constantly receiving impurities, which, not being carried off by the secretions, accumulate in the circulation, and probably aid in causing that depraved condition of the blood, which characterizes the advanced stage of the disease. Mercury is thus called for, as a secretory stimulant, in order to obviate this effect; and, as its influence on the secretions is general, and at the same time mild, it is probably better adapted for the purposes of elimination than more active medicines directed to a special function; while it may less endanger depression. Another strong indication for the use of mercury is offered by the affection of the intestinal glands, which constitutes one of the chief sources of danger, and, as I think from a good deal of experience, is favourably modified by the mercurial impression. It has seemed to me that the subsequent course of the disease has been generally more favourable, when I have had the opportunity of using this remedy in the second stage, than in cases where this opportunity has not been afforded. Still another reason for the practice is the frequent complication of bronchitis, and the occasional occurrence of pneumonia, in both of which the mercurial influence is beneficial. In general, the plan should be commenced about the eighth or ninth day of the disease; one grain of the blue mass being given every two hours, with one-sixth of a grain of ipecacuanha, should the stomach not be irritable, and about the same quantity of opium, if required to check the diarrhœa. As soon as the gums are in the slightest degree touched, the medicine should be diminished, and afterwards so managed as to sustain the same amount of impression so long as required. If the tongue become moist and remain so, the plan may be continued till convalescence shall take place; but if, notwithstanding its use, complete dryness of the tongue supervene, I abandon the use of it, and have recourse to the oil of turpentine.

d. Various Uses.—There are several affections, usually ranked among diseases, in which mercury, on some one of the principles already stated, often proves very useful, and which require a brief notice.

In *dropsy* the remedy sometimes exercises extraordinary powers; but discrimination in its use is important. When the affection is

dependent on an anemic state of system, or is associated with that form of Bright's disease which consists in fatty degeneration of the kidneys, it is strongly contraindicated. In the cases which originate in incurable organic affections of the liver or heart, it can be of no use, while it may do harm by impairing the general strength. But, whenever the dropsy arises from chronic inflammation of the liver, from valvular affections of the heart consequent on fibrinous exudation, or from inflammation or high vascular irritation of the pleura, pericardium, peritoneum, or cerebral meninges, mercury may be combined very advantageously with the diuretics employed, especially squill and digitalis. Hence, it is generally better adapted to ascites, hydrothorax, and hydrocephalus, than to anasarca, though the rule is by no means absolute. Calomel and squill in combination have long been noted for their efficiency in thoracic dropsies. Of course, little good can be expected from the remedy in dropsies, dependent on serous inflammation or irritation, caused by tubercles diffused through the membranes. It is now generally thought that mercury is not appropriate to the *dropsy of Bright's disease* in any of its forms. But when it is connected with inflammation of the kidney, as indicated by fibrinous casts in the urine, without any evidence of conjoined fatty degeneration, I should have no hesitation in having recourse to mercurialization, should the disease not yield to other measures.

Palsy occasionally affords indications for the use of mercury. Whenever there is reason to believe that the disease has been caused, or is kept up by inflammation whether of the spinal marrow, the cerebral centres, or the nerves themselves, and the inflammation refuses to yield to depletory and revulsive measures, a slight and sustained mercurialization should be tried, and will probably be found serviceable. The same may be said of other nervous affections, as *neuralgia*, *epilepsy*, *chorea*, *hysteria*, and even *insanity*. In a special form of the last-mentioned affection, connected with or dependent on *chronic meningitis*, a moderate and persevering use of mercury, with revulsives, offers the best chance of a favourable result. In *hypochondriacal* feelings and delusions, the same remedy may prove useful by correcting disorder of the hepatic function. Some of these nervous affections, moreover, are occasionally mere concealed forms of syphilis, and yield to mercury most happily, after having resisted other means. Examples of this kind are frequently offered in neuralgia; and even paroxysmal convulsions

resembling epilepsy have been traced to a syphilitic origin, and been promptly cured by this medicine.

In the *poisonous effects of lead*, whether in the form of *lead colic* or *lead palsy*, mercury has been imagined to exert a sort of antidotal power, and has been much used with supposed advantage; but it is likely to be superseded by alum and iodide of potassium in these affections. Nevertheless, it may be resorted to, with some hope of benefit, in cases which have resisted these medicines.

Indeed, the remedial influences of mercury are so various and effective that, in any obscure malady, not presenting obvious contraindications, the practitioner would be justified in the careful use of it, in the hope that he might thus cut off the concealed root of the disease, and in the confidence that, if he failed to accomplish his object, he would at least, with due caution, inflict no serious injury.

I have not treated of the various applications of mercury as an exclusively topical agent, preferring to do this in connexion with the several preparations thus used.

4. *Contraindications to the Use of Mercury.*

An agent so powerful for good is necessarily capable of doing mischief, if abused or improperly used.

1. When, from idiosyncrasy, mercury has been found to act injuriously, its use in the same individual should be subsequently resorted to with great caution, and only under urgent circumstances. Of course, the peculiarity of excessive susceptibility to its sialagogue action is no positive contraindication; as its evil effects can be avoided by a degree of caution, in the use of the medicine, proportionate to the susceptibility; but it should serve as an inducement to the utmost watchfulness, and should prevent a resort to the medicine on all trivial occasions.

2. The *suppurative* and *gangrenous* states of inflammation, and the *gangrenous condition generally*, are incompatible with the use of mercury, which, by depreciating still further the character of the blood, and favouring the disintegration of the tissues, would have a tendency to aggravate the affection. A slight degree of suppuration, while the element of excitation still predominates in the inflamed part, should not be allowed to prevent its use, when it is important to limit the inflammation; but it should always be omitted, when either suppuration or gangrene has become fully established. The *occurrence of hectic symptoms* should gene-

rally be received as a signal for suspending its use. To the condition denominated *metastatic abscess, suppurative phlebitis*, and *purulent infection of the blood*, it is altogether unsuitable.

3. *Fatty degeneration*, or a *tendency towards it*, is another condition in which mercury can do only harm. In this, the powers of life in the system at large, or in the part, are enfeebled, and mercury would enfeeble them still further. Besides, it would seem, from the analysis of mercurialized blood by Dr. Wright, that it abounds in fatty matter, showing a strong tendency in mercurialism to favour the oleaginous conversion of the tissues. Hence, the medicine has been found injurious in *chronic Bright's disease*, and should never be used when any considerable amount of oil is discoverable in the urine in that affection, or from any other cause there may be good reason to believe that it is connected with the fatty degeneration of the kidneys. The same remark is applicable to cases in which there may be any suspicion of fatty degeneration of the brain or heart.

4. An *anemic* or *otherwise impoverished condition of the blood*, though it should not be considered as forbidding the use of mercury, when strongly indicated by other coexisting conditions, should be allowed to weigh against it, in doubtful cases; and, when it may be deemed proper or necessary to administer mercury, in such a state of system, care should be taken to guard the blood, as far as circumstances will permit, against further deterioration.

5. In the *scorbutic state* of the blood, and that which attends and characterizes a *malignant condition of system*, in which coagulability is imperfect or wanting, the fibrin is defective or depraved, and the red corpuscles more or less disintegrated, mercurialization is altogether contraindicated; and, when this condition supervenes upon one in which the medicine is employed, it should immediately be suspended, until the blood has been restored to its proper condition.

6. Analogous to the above state of the system are those in which there is a disposition to *phagedenic* or *gangrenous ulceration*, or to *passive hemorrhages*. Even in the treatment of *syphilis*, mercury should be withheld, or omitted, when such a tendency becomes obvious.

7. *Diseases of the spleen* are usually ranked among the contraindicating conditions; and, certainly, in that depraved state of the blood which is so apt to attend them, mercury would seem to be forbidden. Experience, too, has shown that chronic engorgements of that

viscus yield less readily to mercury than similar affections of the liver; but, in simple splenitis, whether acute or chronic, if the system is not anemic, or the blood depraved, I should have no hesitation in resorting to a careful course of mercury, should the affection resist other antiphlogistic treatment.

8. The existence of a *tuberculous* or *scrofulous diathesis* is now generally admitted to contraindicate the use of mercury. So far as the mere inflammation is concerned which attends this diathesis, the medicine has often been found to exercise a curative influence; but it is at the expense of the general system, and at the risk of increasing the disposition to tuberculous deposit. Formerly it was very customary, in this country, to treat phthisis with mercury; but the general experience was that the progress of the disease was hastened: and this application of the medicine has been universally abandoned. In all the scrofulous affections, there is a disposition to an anemic or otherwise impaired state of the blood, which is now believed to favour the formation of tubercle. Mercury has been shown experimentally to have a similar effect on the circulating fluid. Reason, therefore, as well as experience, would forbid it in affections of this kind. There may possibly supervene, upon a scrofulous or tuberculous constitution, some affection to which mercury is peculiarly appropriate, iritis or hepatitis for example, and which might do more injury to the patient than mercurialization would be likely to inflict. Under such circumstances, the physician would be justified in resorting to a very careful use of the remedy, precisely as, in a similar condition, he might be compelled to resort to direct depletion, which is perhaps quite as injurious in relation to the constitutional affection. But mercury should never be used with a direct view to prevent or cure tubercles themselves, and with extreme caution, if ever, to obviate the inflammation which arises directly from them.

9. Finally, *carcinoma*, *melanosis*, *cirrhosis*, *fibrous degeneration*, and similar abnormal conditions, as they are wholly incurable by mercury, and themselves tend to a gradual reduction of the vital forces, should be considered as offering contraindications to its use.

But, in reference to most of the above pathological states, the contraindication must be understood to be against the use of mercury, carried so far as to produce its effects on the system, and not against its pure alterative use, in disorders of the digestive organs, connected with deranged action of the liver, or its employment as a cathartic. Under these circumstances, its influence is mainly con-

fined to the chylopoietic viscera, and is not exerted upon the system at large, or directly on the blood.

5. *Modes of Employing Mercury.*

The modes of employing mercury, both for its alterative effects on the digestive organs, and its operation on the system, have been already detailed, in connexion with the accounts of its several therapeutic applications. It may not be amiss to present them in one view, at the expense of a little repetition.

1. For its *pure alterative influence*, the medicine is to be kept within the point of salivation. Either the mild chloride (calomel), the mercurial pill (blue mass), or mercury with chalk may be used; the two former being preferable for adults, the latter sometimes for children, especially when there is excess of acid in the stomach and bowels. When there is a disposition to constipation, the most convenient method is to administer a dose of the medicine every night or every other night, and to follow it in the morning by a gentle laxative, as one or two drachms of Epsom or Rochelle salt. Sometimes it may be advisable to give the mercurial and the laxative together at bedtime, in which case, rhubarb, or aloes, or the two combined may be employed. From half a grain to two grains of calomel, or from two to eight grains of the blue mass may be given, according to the degree of effect desired, and the less or greater susceptibility of the patient. For children, as they are in general extremely insusceptible to the sialagogue operation of mercury, it is not necessary to reduce the dose in the same proportion as with ordinary medicines. A grain or two of the blue mass, or one-quarter to half a grain of calomel may be given to a child a year or two old; but special care should be taken that the bowels are opened next morning; and, for this purpose, castor oil or magnesia is preferable to one of the salts.

When the stomach and bowels are irritable, in other words in cases of cholera or diarrhœa, it is better to give the medicine in smaller doses frequently repeated. One-sixth of a grain of calomel, or half a grain of the blue mass, may be given every hour or two hours, until the quantity amounts to one or two grains of the former, or from three to six grains of the latter for the day; and it will often be desirable, in order to avoid salivation, to administer the medicine only every other day. In very irritable states of the alimentary canal, even smaller doses than those mentioned may be given with propriety. When the patient is extremely

susceptible to salivation, very minute quantities will often have the effect; and for such a person the amount should be reduced to one-half or even one-quarter. For a child a year or two old, one-twelfth of a grain of calomel, a quarter of a grain of blue mass, or a grain of the mercury with chalk may be given every hour or two, through the day, and omitted at night. Unless in urgent cases, it will be best with children also to employ the medicine only upon alternate days, using other measures in the intervening days.

I do not think that any advantage will accrue, for the purpose here referred to, from the external use of mercury.

2. *With a view to salivation*, the medicine may be used by the stomach, by the rectum, externally, and by inhalation. In the great majority of cases, the internal use of the medicine is amply sufficient; and it is very rarely, except in syphilitic affections, that any other method of application is at all necessary or desirable. I would here again impress on the student and young practitioner the importance of being very guarded in this use of mercury, and watchful against too great an effect on the mouth. It is in general quite sufficient that the slightest observable fetor of the breath, increased flow of saliva, or effect on the gums should be produced; after which, the medicine should be so given as only to keep up this effect. This can be readily done in chronic cases. In the acute, especially those of rapid progress, it is often necessary to run the risk of a greater amount of ptyalism; though, even in these, a little caution will generally be sufficient to prevent any inconvenient amount of soreness.

In *chronic cases*, from half a grain to a grain of calomel, and from two to five grains of blue mass may be given three times a day; and, in two or three days, gradually increased if it shall have produced no effect. In the *acute*, the same dose may be given, but much more frequently repeated; the interval varying from one to three or four hours, according to circumstances, so that the whole quantity given in twenty-four hours may fall between the extremes of four and twenty-four grains of calomel, and twelve grains and a drachm of the blue mass. The smaller quantity should always be used at first, when there is no urgency, and increased as circumstances may seem to require. It is only in the most rapid and dangerous diseases, that the larger quantity mentioned should be given, or even approached; and, in these cases, calomel should generally be preferred; so that it is very seldom desirable to administer more than twelve or eighteen grains of the blue mass

in twenty-four hours. When these doses purge, they should be combined with opium, if not contraindicated. Happily, there is very frequently a coincident indication for the two medicines, in which case they should be given together; and both may often be usefully associated with ipecacuanha.

Should the doses mentioned prove irritant to the bowels, as will sometimes happen even when opium is administered at the same time, a good plan is to exhibit them in extremely minute doses, at proportionably short intervals. Thus, one-twelfth, eighteenth, or even twenty-fourth of a grain of calomel, may be given every half hour till the system is affected; and it will generally be found that a much smaller amount in the aggregate, given in this way, will affect the system, than in larger doses.

Formerly it was not uncommon to give large doses of calomel at once, with a view to salivation; its tendency to act on the bowels being restrained by opium. Five, ten, fifteen grains have thus been given, and sometimes even much larger amounts. But, as only a certain amount of the medicine is dissolved and absorbed within a certain time, the method is not more effectual than that of small doses frequently repeated; and, indeed, often less so, on account of the tendency to purge in these doses, not unfrequently even when combined with opium. But the greatest objection to the plan is, that it places the medicine unnecessarily beyond our control; and, in cases of peculiar susceptibility, very serious effects may ensue.

Corrosive sublimate is sometimes used internally with a view to affect the system; and by some it has been recommended as preferable to the other preparations, from its solubility, and consequently greater uniformity of effect; but I have seldom used it except in syphilitic or syphiloid affections, and am not, therefore, able to speak of it with confidence. More will be said of it among the preparations.

By Enema. It is possible, sometimes, when the stomach is extremely irritable, or mercury from some other cause cannot be given by the mouth, that advantage may accrue from its exhibition in the form of enema; though practically I have very rarely found occasion to resort to this method of administration. The blue mass should be preferred for this purpose, as the mildest preparation. It should be rubbed up thoroughly with some mucilaginous fluid, and given in connexion with an opiate. The dose may be three times

that given by the mouth, and the quantity of liquid vehicle vary from two to four fluidounces.

External Use. When mercury cannot be given, or will not operate by the mouth, or when, from the urgency of the case, it is desirable to introduce the medicine into the system by every avenue, or, finally, when it is thought proper to give it a certain direction, as through diseased lymphatic glands, for example, recourse may be had to its external application, with a view to the production of mercurialism. For this purpose, the officinal *mercurial ointment* may be used; one drachm of it being rubbed daily, or twice a day, upon the inside of the thighs and legs, or of the arms and forearms. These positions are selected because the skin is there more delicate, and the epidermis is more readily permeable. It has been thought, too, that the number of superficial absorbents might still further favour the absorption of the medicine; and that a direction might thus be given to it through the glands in the groin and axilla.

Another method of applying the ointment is as a dressing to blistered surfaces, deprived of the cuticle. It may be used in this way in all cases of urgency, in which a blister has been produced with other intentions, and a surface fit for the purpose has thus been incidentally obtained. It would rarely be justifiable to make a blister for this special object.

The rubbing of calomel or black oxide of mercury upon the inside of the lips, the gums, &c., has also been recommended in reference to the constitutional impression. Two or three grains are used at once. I have not employed this method; but cannot help suspecting that it is only another mode of exhibiting the medicine by the stomach; as I presume that what is rubbed upon the gums will be much more likely to be swallowed than absorbed from the mouth, even when care may be taken to avoid such a result.

Fumigation is still another method. The mercurials, at an elevated temperature, generally rise readily in vapours, which, either inhaled, or applied to the surface, are capable of bringing the system under the influence of the medicine. When inhaled, the vapour operates more rapidly than any other form in which mercury is used, and has, therefore, been recommended in cases in which a very speedy effect is required; the impression being afterwards sustained by the internal use of the medicine. It is also sometimes applied locally to ulcerated surfaces, in order to change the nature of their action. Personally, however, I never meet with cases in

which this mode of using mercury seems to me to be desirable. Violent effects are said sometimes to have resulted from the inhalation of the vapour; and a great objection to the process is the difficulty of regulating the dose, so as to have the medicine under command. More will be said of it when the individual preparations are treated of, which are used in this way. Cinnabar, the black oxide, and calomel have been employed.

6. *Preparations of Mercury.*

All the officinal preparations of mercury, including the metal itself, and excepting only the sulphurets, which appear to be quite inert, are capable of producing the peculiar effects of this medicine on the animal economy. They vary, however, very much in the degree, rapidity, and certainty of their action. M. Mialhe has rendered it probable that they all operate by conversion into bichloride of mercury, and that their difference is owing to the different degrees of facility with which they undergo this conversion. Before the experiments of Mialhe, Prout had stated that calomel, or the protochloride of mercury, in the presence of an alkaline chloride, was converted partially into bichloride. The former chemist has demonstrated that this fact is true of all the officinal preparations, except the sulphuret, and that the action is much more rapid in the presence of the atmospheric air, or a fluid containing it. Another important fact ascertained by M. Mialhe is, that the change into the corrosive sublimate is proportionate, not to the amount of the mercurial present, but to that of the alkaline chloride, and the concentration of its solution. Applying these results physiologically, it would seem that any of the officinal preparations of mercury taken into the stomach, meeting, as they necessarily do, in the alimentary canal, with one of the chlorides, especially that of sodium, and with atmospheric oxygen, either free or held in solution in the liquids, must undergo a partial conversion into corrosive sublimate, by which, if originally insoluble, they become soluble, and consequently capable of being absorbed. Nor is it only the internal operation of the mercurials which is thus explained. When the medicine is applied to the skin, or inhaled in vapour into the lungs, the instant that it meets with any fluid of the body containing chloride of sodium, and there are few which do not, it becomes more or less soluble, and is thus rendered capable of absorption, and circulation with the blood. It will be found that this simple view affords a happy explanation of many peculiarities in the

action of the mercurial preparations. One of these may be mentioned here, namely, the relative insusceptibility of children to the mercurial influence. This is ascribed, upon the hypothesis of M. Mialhe, to the fact, that little salt is used in their diet, and that consequently the conditions requisite to the change do not exist in their alimentary canal. Of the particular reactions which take place with the several preparations, an account will be given when they are individually considered.

It might be inferred from the view here given of the action of the mercurials, that, as all operate through the bichloride produced, it would be unnecessary to use any other than this preparation. But a little consideration will show that this does not follow. The change into corrosive sublimate is, with some of the preparations, exceedingly slow; and particle by particle is presented for absorption as it forms, so that no irritation of the stomach is produced by it; and it is impossible to exhibit corrosive sublimate itself, in doses so small and so frequently repeated, as to obtain the same end. Confirmatory of this statement is the fact, that the different preparations operate with a mildness inversely proportioned to the rapidity of their convertibility into corrosive sublimate, when placed under influences favourable to this result out of the body. Besides, in consequence of the slowness with which the bichloride is generated, the milder preparation has the opportunity of reaching the bowels before the change can take place, and does not, like the corrosive sublimate, exert its first effects on the stomach.

Another practical inference is that, when it is desired that a mercurial should operate mildly, common salt should be avoided; when it does not act, that a little of the salt might be taken at the same time. Caution, however, is requisite on this point; as, by too free an administration of the alkaline chlorides, we might cause an over-production of corrosive sublimate, and consequently irritant effects. This is particularly the case with chloride of ammonium, or muriate of ammonia, which has been ascertained to produce the change more rapidly than any other of the chlorides, and has, on this account, produced poisonous effects when taken internally with calomel.

When any one of the preparations, taken internally, occasions undue irritation of the alimentary canal, Mialhe proposes the hydrated protosulphuret of iron as a corrective. This acts by producing immediately, with any soluble preparation of the metal, an insoluble and inert sulphuret of mercury. In cases of excessive

salivation, the same compound may be exhibited, in order to prevent further absorption of any portion of the mercurial, which may still remain in the alimentary canal.

The preparations of mercury may be arranged under the following heads; namely, 1. those in which it is in the metallic state, 2. the oxides, 3. the chlorides, 4. the iodides, 5. the sulphurets, and 6. the salts.

1. *Preparations in the Metallic State.*

In a state of minute division, it has been ascertained that, in the presence of an alkaline chloride and air, mercury is very slowly converted into corrosive sublimate; the metal probably being first oxidized, and the reaction then taking place between the mercurial oxide and the alkaline chloride. Hence we may account for the influence of the metal, taken internally or applied externally in a state of very minute mechanical division, or inhaled into the lungs or brought into contact with the skin, in the state of vapour.

In its ordinary metallic state, the metal is quite inert. It has been given in quantities varying from an ounce to a pound or more, in obstruction of the bowels, which it is said to have sometimes overcome simply by its weight: the metal passing away per anum unchanged. But at best it is an exceedingly uncertain remedy, and, in a case of irremovable obstruction, might remain in the bowels to the serious detriment of the patient. When long retained in that way, it has been known to produce very powerful if not fatal mercurialization, no doubt through the chemical reaction between its particles, more or less minutely divided among the contents of the bowels, and any chloride of sodium or other chloride that might be present.

It is in that state of minute division, produced by rubbing mercury up with other substances, that the metal is exhibited for its effects on the system. The ordinary metallic appearance is lost in the process, and the metal is said to be extinguished. It has been ascertained that a very minute proportion of oxide is produced, which is increased by time: but there is no reason to suppose that the effects of the medicine are to be wholly or even chiefly ascribed to this oxide; for the metal thus divided is known to be rendered slowly soluble, like the other insoluble mercurials, and a quantity of the oxide, prepared in other modes, equal to that contained in these preparations, would occasion no observable effect. The following are the preparations containing the mercury in minute division.

I. MERCURIAL PILLS.—PILULÆ HYDRARGYRI. *U. S., Ed., Dub.*—PILULA HYDRARGYRI. *Lond.*—*Blue Pills.*—*Pilulæ Cœruleæ.*

Mercurial pills are prepared by first rubbing mercury with confection of roses till the globules disappear, and then beating the mixture with powdered liquorice into a pilular mass. The important point is thoroughly to extinguish the metal, so that, when a little of the mass is rubbed on a piece of glass or paper, no globules can be seen. As much trituration is requisite for the purpose, steam power is most effectively employed.

The preparation may either be kept in the mass (*massa cœrulea* or *blue mass*), or be made into pills, as directed by the U. S. Pharmacopœia. Each of the officinal pills weighs three grains, and contains one grain of mercury.

The mass is at first of a dark-blue colour, but afterwards assumes an olive, and ultimately a slightly reddish tint. It is probable that a minute proportion of protoxide, produced by the absorption of oxygen during the trituration, is increased by time, and at length partially converted into deutoxide; but by far the largest proportion of the metal continues unoxidized, and it is to this that the preparation owes its characteristic properties.

It is one of the mildest of the mercurials, producing when properly prepared, the alterative and sialagogue effects of mercury with considerable certainty, and with little irritation of stomach and bowels. Sometimes, however, it operates as a laxative with griping pain; and the larger the proportion of oxide it contains, the more likely it will be to produce this effect. There is little doubt that the mercury is converted into bichloride in the alimentary canal; and that it owes its superiority in mildness to most of the other mercurials, to the extreme slowness with which this change takes place.

For the simple *alterative* influence on the digestive organs, the dose is from two to five grains every night, or every other night, followed in the morning by a laxative if the bowels should not be opened; or from a quarter to half a grain every hour or two through the day, so that the same quantity may be taken in twenty-four hours.

For full mercurialization, three grains may be given three times a day in chronic cases, and more frequently in acute; but in the latter, as this preparation is preferred to calomel for its greater

mildness, the method best adapted to the end in view, will be to administer it in smaller doses more frequently repeated, as, for example, a grain every hour, or every two hours, till its effects on the gums are perceived.

From five to fifteen grains are given when the effect of a mild mercurial laxative is required; but, when used for this purpose, it should always be accompanied or followed by another laxative; rhubarb or aloes or both being generally preferable in the former case, and a little castor oil or Epsom salt in the latter.

It is usually exhibited in the pilular form; but it may also be given suspended in water by the intervention of mucilage, and may often be added with advantage to the chalk mixture, in bowel complaints, especially those of children.

II. MERCURY WITH CHALK.—HYDRARGYRUM CUM CRETÂ. *U.S., Lond., Ed., Dub.*

This is made by rubbing together three parts by weight of mercury, and five of prepared chalk, till the metal is extinguished. The mercury is not so thoroughly divided in this preparation as in the blue pill; and, therefore, though the proportion of the metal is much greater, its effects on the system are even milder: as, according to the observations of Mialhe, the conversion into a soluble form in the stomach and bowels, takes place more slowly, the less finely the mercury is comminuted.

Mercury with chalk is a grayish powder, which effervesces with an acid, and loses the metal by evaporation with heat, the chalk remaining. Globules of mercury can generally be seen in it with the aid of a magnifying glass.

This is the mildest of the mercurials, and is often preferred in infantile cases on this account, as well as for the antacid properties of the accompanying chalk. But, though somewhat milder than the blue pill, it is less certain. It is more frequently used as an alterative, in infantile disorders of the alimentary canal, with light or clay-coloured stools, indicating defective action of the liver, than for its sialagogue operation. It is sometimes, however, employed in the syphilis of infants.

The dose for adults, in reference to its effects on the system, would be from five to thirty grains, for children two or three grains; but, when intended merely as an alterative in infantile diarrhœa, it may be given in the dose of a grain, every two or three hours through the day. It should be given in powder; as,

in the form of pill, the contraction of the material on drying is apt to cause globules of the metal to form.

The Dublin College directs a similar preparation, made with magnesia instead of chalk, and denominates it HYDRARGYRUM CUM MAGNESIÂ, or *Mercury with Magnesia*. It has similar properties with the preceding, and may be preferably used when a laxative effect is desired.

III. MERCURIAL OINTMENT.—UNGUENTUM HYDRARGYRI. *U. S., Lond., Ed., Dub.*

Mercurial ointment is prepared by rubbing together equal weights of mercury and fat, the latter consisting of lard with one twenty-fourth part of suet. The trituration is to be continued until the globules disappear. A portion of the ointment, rubbed upon paper, should exhibit no globules under an ordinary magnifying glass. Substances are sometimes added, or substituted for the lard, which have the property of facilitating the extinguishment of the mercury; but care should be taken that nothing irritant to the skin is employed, not even rancid lard, as blandness is one of the important requisites of the preparation. So much labour is required for the thorough extinguishment of the metal, that the process is most conveniently conducted by machinery. It should exhibit no globules when rubbed on paper, and examined by a microscope of four powers.

The ointment is of a bluish colour, which darkens with age. Though consisting mainly of the comminuted metal and fatty matter, it always contains a small proportion of oxide, which increases with time. Like the other preparations similarly made, however, it probably owes its efficiency to the slow conversion of the metal, by contact with the fluids beneath the cuticle, into a compound soluble in the blood.

When rubbed upon the skin, or applied to blistered surfaces, it is capable of producing mercurialism, and is not unfrequently employed for this purpose. The circumstances requiring its use, and the method of applying it, have already been sufficiently described. (See *page* 277.) The chief cautions to be observed in its application are, that the operator should protect himself by wearing a thick leather glove, or otherwise covering the hand, and that irritation of the surface should be as much as possible avoided. Sometimes an eruption is produced, with so much inflammation and soreness, as to render a suspension of the application necessary.

Hence the importance of having the ointment properly made. As it is also not unfrequently used as a dressing for blistered surfaces, with a view to its effects on the system, and as inflammation of the blistered surface would not only be uncomfortable to the patient, but might counteract absorption, another reason is offered for having the ointment as bland as possible. When it is applied by friction, the rubbing should be continued till the ointment has been absorbed. In chronic cases, a drachm of it may be used morning and evening until the desired effect is obtained; in more urgent cases, the application may be repeated several times a day.

The ointment is often also used for local effect. In venereal buboes and other obstinate glandular swellings, and in tumours of any kind, not in their nature incurable, it may be rubbed upon the part affected, or upon other parts from which absorbents may pass into the diseased gland. As a dressing for syphilitic ulcers, it has sometimes proved useful, and has been employed in some cutaneous affections, especially in psora, and for the destruction of vermin which may infest the skin. For these latter purposes, it should be diluted with twice or three times its weight of lard. Within a few years, it has been employed locally *for rendering the smallpox eruption abortive*, and the prevention of pitting. For this purpose, it should be applied to the face, on the first appearance of the eruption, spread thickly on patent lint, or on muslin, which may be formed into a sort of mask, and kept closely in contact with the skin, so as to exclude the air. Another mode of using it is, first to soften it with heat, then thicken it with starch or other farinaceous substance, and, while in a semifluid state, to apply it to the whole surface by means of a brush. The only material inconvenience is the salivation which it sometimes induces; but, if the authority of Van Swieten, Huxham, and Boerhaave be allowed weight, this is rather an advantage than an evil; for these celebrated authors sanction the use of mercury in smallpox. It is, however, by no means certain that the mercurial ointment operates, in diminishing the variolous eruption, in any other mode than by excluding the air; and the same may be said of its use in erysipelas and chilblains, in which it has been recommended.

Internal Use. On the continent of Europe, mercurial ointment has been employed internally, with a view to the effects of mercury on the system, and, in the dose of from two to five grains, two or three times a day, is said to salivate with great facility. It may be

given in pill, made by incorporating the mixture with liquefied, or powdered liquorice root.

Compound Cerate of Mercury (CERATUM HYDRARGYRI COMPOSITUM, *Lond.*) is an official of the London College, consisting of mercurial ointment, compound camphor cerate, and camphor, rubbed together. It is used to promote the resolution of indolent tumours.

Mercurial Liniment (LINIMENTUM HYDRARGYRI, *Lond.*; LINIMENTUM HYDRARGYRI COMPOSITUM, *Dub.*) is a mixture of mercurial ointment, lard, camphor, alcohol, and solution of ammonia, sometimes used as a stimulating liniment, to promote absorption in local affections, and for the dispersion of chronic and indolent swellings of the joints, glands, periosteum, &c., whether of syphilitic origin or otherwise. It is said to be more apt to salivate than mercurial ointment, in consequence of the presence of ammonia.

IV. MERCURIAL PLASTER.—EMPLASTRUM HYDRARGYRI. *U.S., Lond., Ed., Dub.*

This is prepared by first melting olive oil and resin together, then rubbing them, after cooling, with mercury until the globules disappear, and, lastly, incorporating the mixture with melted lead plaster, gradually added.

As in the preceding preparations, the mercury exists in this mainly in the state of minute division; and, as with them, it is probable that, so far as the mercury is concerned, it proves effective through the gradual formation, in contact with the skin, of a soluble compound of the metal.

Spread upon leather, and applied to the skin, it has sometimes produced salivation in persons peculiarly susceptible to the mercurial influence, and is sometimes used, in reference to the general effects of the medicine, in chronic inflammation of the viscera, especially the liver and spleen; being applied immediately over the organ affected. More frequently, however, it is used for the dispersion of mercurial swellings, such as bubones, nodes, and other chronic tumefactions of the bones, or soft parts, especially when supposed to be of syphilitic origin.

Plaster of Ammonia and Mercury (EMPLASTRUM AMMONIAE CUM HYDRARGYRO, *U.S., Lond., Dub.*; EMPLASTRUM AMMONIAE ET HYDRARGYRI, *Ed.*) is an official preparation, which is most conveniently made, according to the Edinburgh formulæ, by incorporating the above plaster and ammoniac together. It is used for the same purposes as the preceding, being somewhat more stimulant, and sometimes beneficial in chronic swellings of the parts.

2. *Officinal Oxides of Mercury.*

There are only two of these preparations now officinally recognized, representing the two chemical oxides, the protoxide, namely, and the deutoxide or peroxide. Some chemists consider the latter as the true protoxide, on account of its greater stability, and therefore call the former the *suboxide*, altering the equivalent of mercury accordingly from 202 to 101. This change is medically very unfortunate, as it introduces still further confusion into the nomenclature of important and powerful preparations, just beginning to rise out of a former confusion, which had been the cause of death in more than one instance. I shall adhere to the nomenclature recognized by the U.S. Pharmacopœia.

I. BLACK OXIDE OF MERCURY.—HYDRARGYRI OXIDUM NIGRUM. *U. S.*

Various modes of making this preparation have been employed; but perhaps the best, on the whole, is that of the U.S. Pharmacopœia, which consists in decomposing calomel by means of solution of potassa, washing the resulting oxide, and drying it with a gentle heat. An interchange of principles takes place between the protochloride of mercury or calomel, and the oxide of potassium or potassa, by which the chloride of potassium is formed in solution, and the protoxide of mercury is left undissolved.

As first prepared, the oxide is blackish; but it very soon becomes olive-coloured, and at length not unfrequently presents a slightly reddish tint. It is inodorous, tasteless, insoluble in water and alkaline solutions, but soluble in acetic and nitric acids, and forming with muriatic acid calomel and water. Though a protoxide, consisting of one eq. of mercury and one of oxygen, it is readily decomposed; and, under the influence of light, is resolved partially into deutoxide and metallic mercury, of which the globules may be seen on close inspection. It often also contains a portion of undecomposed calomel. Exposed to a strong heat, it is volatilized, and condenses in metallic globules.

Its operation upon the system resembles that of calomel, though perhaps more variable. According to Mialhe, it is changed into corrosive sublimate or the bichloride in the primæ viæ. The readiest explanation of the change is that one part of the protoxide gives up its oxygen to the other part, forming the deutoxide or binoxide, which then reacts with any alkaline chloride or muriatic acid contained in the stomach.

The black oxide is capable of producing, according to its dose, an alterative, sialagogue, or purgative effect. It occasionally causes considerable irritation, which may sometimes be ascribed to the presence of the deutoxide. The dose as an alterative is from one-quarter of a grain to a grain daily; with a view to general mercurialization, from one to three grains twice or thrice a day. Before being given in larger doses, its freedom from deutoxide should be well ascertained; and at best it can scarcely be considered as suitable for use as a purgative.

Mr. Abernethy employed it for mercurial fumigation. The patient, protected by a complete suit of underclothing, was placed at night in a vapour bath, with the head projecting, and the neck guarded by a cloth, and was exposed, for fifteen or twenty minutes, to the vapours of two drachms of the oxide, put on a heated iron within the bath. He was then transferred to bed, and passed the night in the same garments. Salivation has thus been induced in forty-eight hours; but the cases in which the proceeding would be desirable must be extremely few.

The *Black Wash* or *Lotio Nigra* is made by agitating about a drachm of calomel in a pint of lime-water. By reaction between the calomel and lime, chloride of calcium is formed, which remains in solution, and protoxide of mercury or the black oxide, which subsides. But, with the proportions mentioned, there must be a large proportion of the undecomposed calomel mixed with the oxide. The preparation is used as an application to all kinds of syphilitic ulcers, being always well shaken when applied.

II. RED OXIDE OF MERCURY.—HYDRARGYRI OXIDUM RUBRUM. *U. S., Ed., Dub.*—HYDRARGYRI NITRICO-OXIDUM. *Lond.—Deutoxide of Mercury.—Binoxide of Mercury.—Peroxide of Mercury.—Red Precipitate.*

This is made by dissolving mercury in nitric acid, evaporating the solution to dryness, and exposing the residue to heat in shallow vessels, so long as red vapours escape. Both nitrate of the protoxide and that of the deutoxide of mercury are formed in the first step of the process, and are afterwards decomposed by heat; the metal being oxidized to the maximum at the expense of the acid, which is driven off. The resulting product is the deutoxide of mercury, with a very small proportion of nitrate not entirely decomposed. It is commonly called *red precipitate.*

This oxide is in minute shining scales, of a fine orange-red

colour, and an acrid metallic taste. It may be considered as virtually insoluble in water; requiring, according to Dr. Christison, 7000 parts of that liquid for solution. It is dissolved by nitric and muriatic acids. With a moderate heat, it yields oxygen, and at a red heat is decomposed and dissipated. It should always be rubbed into very fine powder before being used.

Effects on the System. Externally, the red oxide of mercury is powerfully irritant, and even escharotic when applied to ulcerated or excoriated surfaces. Internally it is capable of affecting the system like the other preparations of mercury; but is liable to be very harsh in its action, sometimes causing vomiting and purging, in doses in which it produces little obvious effect at other times, and capable in over-doses of causing dangerous gastro-enteritis. There can be little doubt that it acts, whether externally or internally, mainly through conversion into corrosive sublimate. This conversion, depending on the presence of the alkaline chlorides or muriatic acid, is not constant in the same degree; and hence the inequality in the action of the medicine. Under favouring circumstances it takes place rapidly, and gives great energy to the preparation. Mialhe supposes that the change is effected by an interchange of principles between a portion of the alkaline chloride and the mercurial oxide, resulting in the formation of the deuto-chloride of mercury and the pure alkali, the former combining with a portion of undecomposed alkaline chloride to form a double chloride of the mercury and alkaline metal. Were it not for this latter combination, the deutochloride could not exist in the presence of the generated alkali.

Therapeutic Application. In consequence of its inequality of action, and occasional violence, the red oxide should not be used internally. If given, the dose should not exceed one-quarter or half a grain.

At present it is used exclusively as an external remedy, for its locally alterative, stimulant, or escharotic effect, in syphilitic ulcers, in old indolent, flabby, or fungous ulcers whether syphilitic or not, in various cutaneous eruptions, and in different diseases of the eye or its appendages. It is used in the form of powder, ointment, or lotion.

The *powder* is sometimes sprinkled, as an escharotic, on chancres, and indolent or flabby and fungous ulcers; and diluted with eight or ten parts of very finely powdered sugar, is blown into the

eye for the removal of opacity of the cornea. Great care should be taken that the oxide is very finely powdered.

The *Ointment* (UNGUENTUM HYDRARGYRI OXIDI RUBRI, *U. S.*, *Dub.*; UNGUENTUM HYDRARGYRI NITRICO-OXIDI, *Lond.*; UNGUENTUM OXIDI HYDRARGYRI, *Ed.*) commonly called *red precipitate ointment*, is made by rubbing a drachm of the red oxide, very finely powdered, with an ounce of simple ointment previously softened by heat. It is at first of a fine orange-red colour, which gradually darkens by time into a dirty leaden hue, probably owing to the partial deoxidation of the deutoxide through the agency of the fatty matter. It should, therefore, not be kept long; but prepared as wanted.

This ointment is often used as a dressing for ulcers such as above referred to, and as an application to certain cutaneous diseases, particularly porrigo, the advanced stages of impetigo of the face and scalp, and the scaly affections. It may be used also in psorophthalmia, being carefully applied to the edges of the affected lids; and, more or less diluted, is occasionally introduced into the eye in obstinate chronic ophthalmia, with thickening of the palpebral conjunctiva, and specks on the cornea.

The *Phagedenic Lotion* (*Aqua Phagedænica*, or *Lotio Phagedænica*) is made by adding corrosive sublimate to lime-water, in the proportion of two grains to a fluidounce. By mutual decomposition between the bichloride of mercury and the oxide of calcium or lime, chloride of calcium and red oxide of mercury are generated, the former of which remains dissolved, and the latter is thrown down. Of course, whenever the preparation is used, it must be well shaken. It was formerly much employed, as a wash, in the ulcers and cutaneous eruptions above referred to; being applied to the former by means of lint, or folded linen wet with it, and to the latter by lotion. Trousseau speaks of it favourably as a wash in all cases in which solution of corrosive sublimate is used, and especially in pruritus of the vulva, diluted with from twice to four times its bulk of warm water.

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3. *Officinal Chlorides of Mercury.*

Under this head are placed calomel or the protochloride, corrosive sublimate or the deutochloride, and white precipitate, which may be considered as a chloro-amidide of mercury.

I. MILD CHLORIDE OF MERCURY or CALOMEL.—HYDRARGYRI CHLORIDUM MITE. *U. S.*—HYDRARGYRI CHLORIDUM. *Lond.*—CALOMELAS. *Ed., Dub.*—*Protochloride of Mercury.*—*Subchloride of Mercury.*

Calomel is prepared by first forming a sulphate of the deutoxide of mercury, by boiling sulphuric acid and the metal together to dryness. This is then rubbed with a quantity of mercury equal to that which it contains, and afterwards with chloride of sodium in a certain proportion, and finally submitted to sublimation. It may be supposed that the mercury forms with the deuto-sulphate first obtained, a sulphate of the protoxide, which reacts with the chloride of sodium, so as to form sulphate of soda, which remains, and protochloride of mercury which is sublimed. The vapours condense into a heavy crystalline cake, which is to be finely powdered, and washed thoroughly with boiling distilled water, in order to separate some corrosive sublimate, which is always formed, and sublimes with the calomel. This impurity is known to have been completely removed, when the washings do not yield a white precipitate with solution of ammonia.

Properties. As above prepared, calomel is a heavy, yellowish-white or ivory-coloured powder, inodorous, tasteless, and insoluble in water, alcohol, and ether. It is darkened by exposure to light, but otherwise is unalterable in the air. It is completely dissipated by heat. According to the view which considers the combining number of mercury as 202, it consists of one equivalent of the metal and one of chlorine.

Incompatibles. Calomel is decomposed by the *alkalies* and *alkaline earths*, with the formation of the black oxide of mercury. The *alkaline carbonates*, *soaps*, and *soluble sulphurets* also decompose it; and the same is said to be the case with several of the metals. *Nitromuriatic acid* probably converts it into corrosive sublimate; and I have been informed of a case, in which these medicines were jointly administered, with the apparent effect of causing excessive vomiting and purging, which ended fatally. *Alkaline chlorides* have the same effect, but much more slowly. *Chloride of ammonium*, however, or *muriate of ammonia* acts with considerable energy; and a fatal case is on record, in which death was supposed to have resulted from the use of this salt simultaneously with calomel. *Hydrocyanic acid* also decomposes calomel, forming corrosive sublimate and deutocyanuret of mercury; and should not, therefore, be given along with it. For the same reason, all the natural products con-

taining hydrocyanic acid, such as *oil of bitter almonds, bitter-almond water, cherry-laurel water, syrup of orgeat, infusion of wild-cherry bark*, &c., should be used with caution, if at all, when calomel is administered.

Effects on the System. Calomel is of itself scarcely irritant; but, in consequence of the change it undergoes when in contact with the liquids of the body, and of course with the mucous surfaces, or those of ulcers or abrasions, it becomes so in a greater or less degree, corresponding with the rapidity of the change. The nature of this alteration has been already referred to. According to Mialhe, whose views, to say the least, are extremely plausible, whenever calomel comes in contact with the animal liquids, containing an alkaline chloride, the chloride of sodium, for example, it is converted partially into corrosive sublimate; one part of the protochloride giving up its chlorine to the other so as to form deutochloride with reduction of a portion of the metal; and the salt thus formed combining with the alkaline chloride which gives it stability. It is thus the corrosive sublimate, or the compound of this with the alkaline chloride that is the real agent, whenever calomel operates in any way, either locally or upon the system. In this way, peculiarities in the operation of the medicine, before unaccountable, are explained without difficulty.

Calomel produces on the system all the effects, already fully described, which characterize the mercurial preparations; and, on the whole, is the best of them for internal use, being at the same time, when properly guarded, in general mild in its operation, and yet certain and effective. In large doses, it is purgative and anthelmintic; and, in still larger doses, it is thought, with a moderate purgative effect, to have a peculiar sedative influence upon the alimentary mucous membrane, for which it has been much used in cholera and dysentery, with great asserted advantage. In these several relations, I shall treat of the medicine among the catharics and anthelmintics.

Many instances have been recorded, in which calomel has operated poisonously; in some destroying life by excessive salivation, in others, by a powerful irritant influence on the alimentary mucous membrane. Yet the cases are infinitely more numerous, in which it has been administered in enormous doses, often as much as drachms at a time, and, taking the aggregate of the doses given at short intervals, amounting sometimes to ounces, or even a pound, within a very few days, without any observable physiological results

whatever, except some depressing sensations in the abdomen, moderate purgation, or a slight salivation, and not always these. I have heard of a practitioner, who was in the habit of giving calomel by the teaspoonful, in certain violent cases of disease; and it is quite certain that many of his patients escaped without injury. With our present lights on the subject, it is not difficult to explain these discrepancies. Merely as calomel, the remedy is bland and probably inert. By conversion, however, into corrosive sublimate, it acquires activity; and this activity is just in proportion to the quantity of the soluble compound produced. But the change is due to the alkaline chlorides present, and is proportionate to their amount. If there should be little of them, their power will soon be exhausted, and the calomel will produce but moderate effects, the greater portion remaining unchanged and inert in the bowels; and, so far as regards immediate effects, it differs little how much this inert remainder may amount to, whether to grains or to drachms. The effect is the same whether the chlorides pre-exist in the primæ viæ, or are introduced. The inference from all this is, that when calomel operates violently, either as an irritant or sialagogue, it meets with an unusual proportion of the alkaline chlorides in the primæ viæ, either secreted or introduced; and, when comparatively inert, that it is so because it encounters little or none of these salts. Now, whether this explanation is admitted or not in its precise terms, it is at least highly probable that the different results obtained from the medicine are owing to its different degree of solubility, under varying circumstances, in the liquids of the alimentary canal.

Therapeutic Application. So far as concerns the alterative and sialagogue effects, enough has been said on this subject already. I would, however, urge on the young practitioner, the importance of a guarded use of the medicine, and of not allowing himself to be deceived, by the impunity with which it is often carelessly given, into the very erroneous supposition that this apparent harmlessness can always be relied on. He should also carefully guard against those influences, above referred to, which are calculated to give intensity to the action of the medicine.

Administration. Calomel may be given in the form of pill, or that of powder. The pill may be made with gum arabic and sugar; but, if desired to act quickly and vigorously, should be freshly prepared. The powder may be given in syrup or molasses.

The alterative dose is from half a grain to two grains, every night or every other night, to be followed, if there has been no

action on the bowels, by a gentle laxative in the morning. When the stomach and bowels are irritable, the dose may be one-sixth or one-eighth of a grain, given every hour or two, so that the same quantity may be taken in the twenty-four hours.

For the general mercurial effect, as indicated by the sore-mouth, from half a grain to a grain three times a day, may be given in chronic cases, and increased if necessary. In acute cases, the quantity may be increased to from four to twenty-four grains in twenty-four hours, according to the urgency of the symptoms; the several doses not exceeding, as a general rule, one or two grains. It is much better thus to give the medicine in small and repeated doses, as they are more likely to act on the system, and less liable to produce gastric or intestinal irritation. Should the stomach and bowels be irritable, it may even be advisable to follow the practice of Dr. Law, of Dublin, and give extremely minute doses, as from the twenty-fourth to the twelfth of a grain repeated at very short intervals. It has been found that a much smaller quantity of the mercurial thus given will produce salivation, than as ordinarily exhibited.

When calomel is found unexpectedly irritating, it should be carefully tested for corrosive sublimate, the presence of which is probably one of the causes of the occasional harshness which it exhibits. Should water in which calomel has been agitated, yield, after filtration, a white precipitate with solution of ammonia, it would indicate the presence of this impurity.

Topical Use. Calomel has been employed topically for various purposes. It has been snuffed up the nostrils in ozæna; blown into the eyes in chronic ophthalmia, with or without specks in the cornea; employed as a gargle, suspended in mucilage, in ulcers of the throat; introduced into the larynx, by inhalation, in chronic inflammation of that organ; injected into the urethra in gonorrhœa; and, in the state of ointment made with a drachm of calomel to an ounce of lard or simple ointment, used as a dressing for indolent or specific ulcers, and by inunction in chronic cutaneous eruptions. It has also been used for fumigation.

Jewell's calomel, Howard's calomel, or the *hydrosublimate of mercury*, is a preparation made by condensing the vapours, as they proceed from the materials for preparing calomel, in contact with steam, whereby they are thoroughly cleansed from corrosive sublimate, and the resulting preparation obtained in a state of finer division, and more impalpable, than in the ordinary mode of pulverization. Another mode of attaining the same object of minute division is

that proposed by M. Soubeiran, of effecting the condensation in a current of air. The calomel thus prepared is whiter, and considerably lighter than that ordinarily used, and, in consequence of its more complete comminution, is said to be acted on more rapidly by the alkaline chlorides, and consequently to be rather more active when taken into the stomach. The latter quality is a disadvantage; as the superiority of calomel over other mercurials, is owing to its union of mildness with efficiency; but, from its impalpable character, the hydrosublimate is more esteemed for introduction into the eye.

There are two officinal preparations of calomel intended for use as alteratives, or with the view of obtaining the mercurial influence, which require a brief notice.

1. The *Pills of Mild Chloride of Mercury*, or *Calomel Pills* (PILULÆ HYDRARGYRI CHLORIDI MITIS, *U. S.*), consist of calomel made into the pilular form by means of powdered gum arabic and syrup, and contain each one grain of the mercurial. They are intended simply as a convenient form for administration, and to facilitate prescription.

2. The *Compound Calomel Pills* (PILULÆ CALOMELANOS COMPOSITÆ, *Ed.*, *Dub.*; PILULA HYDRARGYRI CHLORIDI COMPOSITA, *Lond.*) consist of calomel, with an equal weight of precipitated sulphuret of antimony, and a little guaiac and molasses. They are often called *Plummer's pills*, after Dr. Plummer, who first employed them. They are considered as peculiarly applicable to scaly and other eruptive diseases of the skin, and chronic rheumatism, especially when of syphilitic origin, and are said to be useful also in chronic hepatitis, and disorders of the digestive organs connected with deficient action of the liver. If, however, it be true, as stated by Vogel, that they are ultimately converted into sulphuret of mercury and terchloride of antimony, they must in the end owe their virtues to the antimonial alone, as the sulphuret of mercury is nearly or quite inert.

II. CORROSIVE CHLORIDE OF MERCURY or CORROSIVE SUBLIMATE.—HYDRARGYRI CHLORIDUM CORROSIVUM. *U. S.*—HYDRARGYRI BICHLORIDUM. *Lond.*—SUBLIMATUM CORROSIVUM. *Dub.*—SUBLIMATUS CORROSIVUS. *Ed.*—*Deutochloride of Mercury.*—*Bichloride of Mercury.*—*Perchloride of Mercury.*—*Chloride of Mercury.*

Corrosive sublimate is prepared by first forming, as in the process for calomel, the sulphate of the deutoxide of mercury, and

afterwards submitting this to sublimation in connexion with chloride of sodium. An interchange of principles takes place, by which sulphate of soda and the deutochloride of mercury are formed, of which the former remains behind, and the latter passes over in vapour, and is condensed in a proper recipient.

Properties. As kept in the shops, corrosive sublimate is usually in heavy, white, translucent, crystalline lumps, unchangeable in the air, inodorous, of an exceedingly acrid, styptic, metallic, and persistent taste, soluble in eighteen or twenty parts of cold, and three of boiling water, and very soluble in alcohol and ether, the latter of which will partially abstract it from its watery solution. It is soluble, also, without change, in sulphuric, nitric, and muriatic acids. The alkaline chlorides unite with it, forming double chlorides, and thus rendering it more soluble in water. It melts when heated, and, at a higher temperature, is volatilized without change.

Incompatibles. The *alkalies* and *alkaline earths* decompose it, causing a red, orange, or yellow precipitate of the deutoxide of mercury, with the exception of *ammonia*, which produces a white precipitate. The alkaline protocarbonates also throw down the red oxide. It is decomposed by the *soluble salts of lead* and *silver*, by *tartar emetic*, *iodide of potassium*, and the *soluble sulphurets*. With *albumen* and *fibrin*, it forms insoluble, or but very slightly soluble compounds; which, however, if recent, are dissolved by acid and alkaline liquids, and by solutions of the chlorides of potassium, sodium, and calcium. In consequence of the combination which it forms with albumen and fibrin, it protects animal substances against putrefaction. The solution, when exposed to light, is gradually decomposed; but the change is prevented by the presence of the alkaline chlorides.

Effects on the System. Corrosive sublimate is a powerful local irritant, producing, when applied to any surface, whether internal or external, either irritation, inflammation, or corrosion, according to the quantity applied, and the degree of concentration. Its corrosive property is ascribable to its affinity for the albuminoid constituents of the tissues, with which it unites chemically, with the effect of producing disorganization. Its external effects, however, will be considered more fully under the escharotics.

Taken internally, in very small doses, it is capable of operating on the system, without disagreeably affecting the stomach and bowels. The opinion has been very generally entertained, that it has less tendency than most other mercurials to produce sore-

mouth, even while bringing the system at large under its influence, as evinced by a somewhat increased action of the heart, an augmented flow of perspiration or of urine, and the curative effects which often result. There is probably some truth in this opinion, though the fact, admitting it to be such, is not very satisfactorily explicable, in accordance with the most probable views of the action of mercurials. Perhaps, however, the difference between it and the other preparations, in this respect, may be rather apparent than real. We give the milder preparations more freely, it may be, than is necessary for their curative effect, because we have no apprehension of local injury from an over-dose. Perhaps, were we to prescribe them less freely, we might witness all the effects which we obtain from corrosive sublimate, with an equal exemption from ptyalism. But, in relation to this mercurial, we are compelled to give it in very small doses, to avoid injury to the stomach and bowels. On account of this apparent peculiarity of curing syphilitic diseases without salivating, corrosive sublimate has long been a favourite medicine with empirics, who profess to cure syphilis without mercury.

Even in ordinary medicinal doses, the medicine sometimes acts as an irritant, producing nausea, griping pains, and sometimes vomiting or purging, though the former effect is rare. This result may generally be obviated by combining it with a little opium. If, however, it be persevered with, under such circumstances, especially in somewhat large doses, there is danger of producing a chronic inflammation of the alimentary mucous membrane, which may have serious consequences.

Though less liable to salivate, in ordinary doses, than other mercurials, it will generally, if persisted in, sooner or later affect the mouth, and sometimes violently so. I have before referred to a case, which fell under my own observation, in which salivation was apparently induced by two doses of one-sixth of a grain each.

Poisonous Effects. When taken largely, corrosive sublimate acts as a powerful corrosive poison. If given in successive doses, so as to bring about the poisonous results gradually, severe ptyalism is often induced, with all its most unpleasant accompaniments. In such cases, there is usually, after each dose, more or less colicky pain, with nausea and vomiting; and the patient dies at length of the combined effects on the stomach and bowels, and upon the mouth and fauces, in which the lungs not unfrequently participate,

as indicated by dyspnœa, cough, and bloody expectoration. Tremors and paralysis sometimes precede death.

When a single poisonous dose has been taken, large enough to destroy life, the symptoms are a strong acrid metallic taste; a sense of constriction and burning in the œsophagus; excruciating pain in the stomach, which, however, is sometimes wanting; nausea, and frequent vomiting of mucus, often mixed with blood; and generally violent purging, with or without blood in the stools. The system is usually greatly prostrated, and cramps in the extremities, and sometimes convulsions precede death. Not unfrequently the patient lives several days, in which case the true mercurial ptyalism is apt to occur. Profuse discharge of saliva sometimes takes place much earlier; but this is owing to the direct irritant action of the poison on the mouth, or a sympathetic result of the gastric disturbance. If the patient survive the gastro-enteritis, he sometimes lingers long under the disease of the mouth and fauces, which, by the occurrence of sloughing and extensive ulceration, may prove fatal.

On examination after death, the usual marks are discovered of inflammation or corrosion of the mucous membrane of the stomach and bowels. The internal surface is often found of a slate-gray colour, and that of the mouth is white or bluish-gray; effects which are somewhat characteristic of the action of this poison.

The smallest quantity which is known to have caused death is three grains, and that was in the case of a child. (*Taylor on Poisons*, Lond. 1848, p. 402.)

Several cases are on record of death from the external application of corrosive sublimate, in which its poisonous constitutional effects were experienced, both as exhibited in the alimentary canal and the mouth. In one instance, that of a child, though the poison had produced extensive sloughing in the part to which it had been applied, absorption nevertheless took place, and a most violent effect upon the mouth came on, attended with gangrene. In another instance, occurring in an adult, on examination after death, the alimentary canal was found strongly inflamed, and the lower part of the colon and rectum were in a state of sphacelus. Other facts in great number might be adduced, to show that the medicine, when absorbed from the surface, exercises on the stomach and bowels a similar irritant influence as when swallowed.

Treatment of Poisoning. The stomach should be well washed out by the free use of demulcent drinks, with which some antidote

should be administered. Albumen, in the form of the white of eggs, as the most convenient, should be immediately resorted to, or, in the absence of this, milk or wheat flour; for, though these may not completely neutralize the poison, they certainly tend to lessen its activity; and it is of the utmost importance not to lose time. The most efficient antidote, when it can be obtained, is probably the hydrated protosulphuret of iron. After the stomach has been cleansed, a cathartic should be given with the antidote; and measures afterwards employed to counteract the inflammation and irritation, for which purpose the aid of opium will be highly valuable.

Mode of Operation. Corrosive sublimate is capable of producing its characteristic effects on the system, both through the alimentary canal and the skin. Meeting with albuminous matters in the tissues and liquids with which it is brought into contact, it probably unites with these even when given in small doses, forming an albuminate of the salt, from which it is probably dissolved through the agency of the alkaline chlorides in the blood, and thus enters the circulation not strictly as corrosive sublimate, but as a compound of this and the alkaline chloride.

Therapeutic Application. In reference to the uses of corrosive sublimate as a topical remedy, I shall speak hereafter. For its effects on the system it is much less used than some of the other mercurials, on account of its occasional harshness, and the danger of giving it in such doses as to insure a decided constitutional impression. Its use is confined mainly to secondary venereal affections, chronic rheumatism of a peculiarly obstinate character, and chronic cutaneous eruptions, whether syphilitic or not. It is usually administered with other alteratives, especially the compound decoction, and compound syrup of sarsaparilla. With the latter, however, unless taken promptly after the mixture, it is liable to undergo decomposition, and to be converted into calomel. An objection has been made to its administration in connexion with albuminous or glutinous substances, under the impression that it might thus be rendered insoluble and inert; but, as suggested by Soubeiran, this is probably the safest way of administering it; as its corrosive effects are thus obviated, while, being soluble in the blood, it is probably taken into the circulation without difficulty.

Administration. The dose of corrosive sublimate is from one-sixteenth to one-quarter of a grain, three or four times a day. Should it irritate the stomach and bowels, in any dose given, this

should be diminished, or a little opium may be administered with it. The most convenient method of exhibition is usually that of pill, which may be made with the crumb of bread; great care being taken to diffuse the medicine equally through the mass.

Corrosive sublimate is frequently used on the continent of Europe, in the form of a bath, with a view as well to its constitutional impression, as to a local effect on the skin. In this mode it is applied chiefly to obstinate cutaneous affections. In the Hôtel Dieu of Paris, a bath is used containing at first half an ounce of the corrosive sublimate, which is sometimes increased to an ounce or even two ounces; only half the quantity being used in the cases of women. In describing the effects of these baths, MM. Trousseau and Pidoux state that they first produce heaviness of the head and drowsiness, with slight pains in the stomach, and sometimes, though rarely, vomiting and diarrhœa. After several repetitions of them, a papulous eruption is apt to appear on the legs, which is occasionally so inconvenient from the itching and pain, that it is necessary to suspend the bathing. The remedy is not pushed to ptyalism unless in syphilitic cases. The baths are given every other day, and on the intervening day the patient is immersed in a bran bath. The effects of the remedy are described as most happy in the cure of obstinate skin diseases. (*Trait. de Thérap.*, 4e éd., i. 201–2.) Sulphuretted baths used conjointly, cause a blackening of the skin, which does not disappear till after desquamation. Pediluvia may be employed also to affect the constitution, having the strength of half a grain of the chloride to a pint of water.

A *Solution of Corrosive Sublimate* (LIQUOR HYDRARGYRI BICHLORIDI, *Lond.*) is directed by the London College, consisting of ten grains, each, of the bichloride and of muriate of ammonia, in a pint of distilled water. The dose is from one to four fluidrachms, containing from one-sixteenth to one-fourth of a grain of the corrosive sublimate, to be taken in some mucilaginous liquid.

III. AMMONIATED MERCURY or WHITE PRECIPITATE. —HYDRARGYRUM AMMONIATUM. *U. S.*—HYDRARGYRI AMMONIO-CHLORIDUM. *Lond.*, *Dub.*—HYDRARGYRI PRECIPITATUM ALBUM. *Ed.*—*Chloro-Amidide of Mercury.*—*Amido-Chloride of Mercury.*

This is made by simply precipitating a solution of corrosive sublimate with solution of ammonia, and washing the precipitate

till the washings are tasteless. The most probable explanation of the reactions which take place is that given by Sir Robert Kane. Assuming the existence of a compound radical consisting of one equivalent of nitrogen and two of hydrogen (NH_2), which is ammonia deprived of one equivalent of hydrogen, and is denominated *amidogen;* it is only necessary to suppose that one of the two equivalents of chlorine, contained in the deutochloride of mercury, is replaced by one of amidogen, thus forming a *chloro-amidide* of mercury. To produce amidogen, one of the equivalents of hydrogen leaves a portion of the ammonia, and combines with the equivalent of chlorine lost by the corrosive sublimate, forming muriatic acid, which, combining with an equivalent of undecomposed ammonia, remains in solution as muriate of ammonia.

Properties. Ammoniated mercury is in the form of a white powder or pulverulent masses, inodorous, of a slight earthy and metallic taste, insoluble in water and alcohol, and soluble without effervescence in muriatic acid. It is decomposed and dissipated by a strong heat. It may be distinguished from calomel by undergoing no change on the addition of ammonia, and by not being blackened by trituration with lime-water. Like most of the other mercurials, it yields, according to Mialhe, corrosive sublimate to the alkaline chlorides.

Little is experimentally known of its operation upon the system; but there can be no doubt that it would produce the general effects of the mercurials. Fatal cases of poisoning by it have been reported. It is employed exclusively as a topical remedy, usually in the form of an ointment, which is officinal.

Ointment of Ammoniated Mercury, or *White Precipitate Ointment* (UNGUENTUM HYDRARGYRI AMMONIATI, *U. S.:* UNG. HYDRARG. AMMONIO-CHLORIDI, *Lond.;* UNG. PRECIPITAT. ALB., *Ed.*), made by rubbing a drachm of ammoniated mercury with twelve drachms of simple ointment, is used to destroy pediculi, and as a stimulant alterative in indolent ulcers, psorophthalmia, and various cutaneous eruptions, as scabies, chronic impetigo, and favus or scald-head.

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4. *Officinal Iodides of Mercury.*

Of these there are only two, the iodide and deutiodide, which are distinguished in the U. S. Pharmacopœia as the iodide and red iodide, in order to avoid the confusion of changing nomenclature, by fixing on some unalterable quality as the basis of the title.

I. IODIDE OF MERCURY.—HYDRARGYRI IODIDUM. *U. S., Lond.*—HYDRARGYRI IODIDUM VIRIDE. *Dub.*—*Protiodide of Mercury.*—*Subiodide of Mercury.*

This may be made by simply rubbing iodine and mercury together in proper proportions, a little alcohol being added to facilitate the process; or by reaction between calomel and iodide of potassium, in which case an interchange of principles takes place, with the formation of chloride of potassium, which may be removed by washing, and of iodide of mercury which remains. It sometimes contains deutiodide, from which it may be freed by washing it thoroughly with boiling alcohol.

Properties. Iodide of mercury is a heavy, yellowish-green powder, inodorous and tasteless, insoluble in water or alcohol, but soluble in ether, and slightly soluble in solution of iodide of potassium. It is darkened on exposure to light. At a high temperature it is volatilized. Mialhe has shown that, though less readily dissolved by the alkaline chlorides than some other mercurials, it is slightly affected by them, and is even more readily affected than calomel by muriatic acid. It probably, therefore, owes its activity to the solvent agencies of these substances. (*Chimie Appliq. à la Physiolog.*, Paris, A. D. 1856, p. 420-1.)

Effects on the System. Iodide of mercury produces the effects of the mercurials generally: but different opinions are entertained of the degree of its activity. M. Gibert considers it much more active than calomel, but less apt to produce salivation, while it is less poisonous than corrosive sublimate. (*Ibid.*, p. 419.) Dr. Pereira says that it is a powerful irritant poison. (*Mat. Med.*, 3d ed., p. 868.) MM. Trousseau and Pidoux consider it a "powerful, indeed very powerful medicine." (*Trait. de Thérap.*, 4e éd., i. 187.) On the other hand, M. Claude took nine grains with no other effect than an evacuation from the bowels more than twenty-four hours afterwards; and M. Ricord carries the amount of it, which he gives daily, to six or eight grains without inconvenience. (*Chim. Appliq. à la Physiol.*, 422.) The probability is that iodide of mercury is of itself not more active than calomel, and when pure may be given in the same doses. But it is frequently contaminated with the deutiodide, which is a very powerful preparation; and its occasional harshness may be accounted for in this way. Besides, it is dissolved by solution of iodide of potassium, thus being rendered much more energetic; and, as the two may often have been given

together, it is very possible that its reputation for extraordinary energy may have arisen partly from this cause. M. Mialhe believes that, when acted on by iodide of potassium, it undergoes a change analogous to that of calomel with alkaline chlorides; is converted, namely, into mercury and the deutiodide; so that it is the latter preparation, and not the protiodide that acts. (*Ibid.*, p. 423.) The practical inference is, that great care should be taken to use the protiodide thoroughly free from deutiodide, and that the medicine should not be used simultaneously with iodide of potassium.

Therapeutic Application. Iodide of mercury has been found very useful in syphilis; being preferred, in some degree, probably, under the impression that it is less liable to salivate than calomel. Its composition, moreover, obviously suggested its preferable use in cases of that disease associated with scrofula; and this is perhaps its most useful application. The dose is a grain two or three times a day, to be gradually increased until the desired effect is produced, or until some unpleasant symptom shall appear. It is most conveniently given in the form of pill.

An *Ointment* (UNGUENTUM HYDRARGYRI IODIDI, *Lond.*) is directed in the London Pharmacopœia to be prepared by rubbing an ounce of the iodide with two ounces of wax, and six of lard, previously melted together. It is used for certain skin affections of a scrofulous character, as lupus; and as a dressing for scrofulous, or scrofulo-syphilitic ulcers.

II. RED IODIDE OF MERCURY.—HYDRARGYRI IODIDUM RUBRUM. *U. S., Dub.;* HYDRARGYRI BINIODIDUM. *Ed.—Deutiodide of Mercury.—Biniodide of Mercury.—Periodide of Mercury.*

This is prepared by precipitating a solution of corrosive sublimate, by means of another of iodide of potassium. The reaction, through an interchange of principles, results in the formation of chloride of potassium, which remains in solution, and the deutoxide of mercury which is thrown down. The precipitate is to be well washed, dried, and kept in a closely stopped bottle.

Properties. This preparation is usually in the form of a heavy, scarlet powder, inodorous, of a very slight metallic taste, insoluble in water, but soluble in heated alcohol, and in solution of the chloride of sodium, iodide of potassium, and in other soluble iodides, with which it is disposed to combine chemically, forming double iodides. When heated it melts, and on solidifying assumes a yellow colour, which it again changes for red on further cooling, or on being

mechanically disturbed. At a higher heat it is vaporized, and condenses in yellow scales, which also become red on cooling. These are sufficiently characteristic properties.

Effects on the System. These are both locally and generally like those of corrosive sublimate, though perhaps somewhat less violent. It probably acts through the agency of the chloride of sodium in the liquids of the body, which enables them to dissolve it.

Therapeutic Application. As the red iodide of mercury is capable of bringing the system under the mercurial influence, it is applicable to the same purposes as most of the mercurials, and especially to the treatment of scrofulous syphilis; but its harshness, and the danger that might arise from an over-dose, have prevented its use to any extent as an internal remedy.

Externally it is employed as a powerful alterative stimulant and escharotic, in obstinate ulcerous diseases, and has been found by Cazenave especially useful in lupus. Forming it into an ointment with equal parts of olive oil and lard, he applies it in a thin layer over a portion of the diseased surface, which becomes violently inflamed, and, on the subsidence of the inflammation, is left in a state disposed to heal. In the form of very dilute ointment, it has been used in opacity of the cornea, and obstinate disease of the eyelids.

An *Ointment* (UNGUENTUM HYDRARGYRI IODIDI RUBRI, *Dub.*) is directed in the Dublin Pharmacopœia to be made by rubbing a drachm of the iodide with seven drachms of simple ointment. This may be applied to indolent and insusceptible scrofulous ulcers, and, much diluted, to other chronic ulcerations of a less obstinate character. For application to the eye, as above mentioned, it should be diluted with at least four times its weight of lard or simple ointment.

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5. *Officinal Sulphurets of Mercury.*

I. RED SULPHURET OF MERCURY or CINNABAR.—HYDRARGYRI SULPHURETUM RUBRUM. *U. S.*—HYDRARGYRI BISULPHURETUM. *Lond.*—CINNABARIS. *Ed.*—*Deutosulphuret of Mercury.*—*Bisulphuret of Mercury.*—*Persulphuret of Mercury.*

This is made by heating mercury and sulphur together, and then subliming. The two unite in the proportion of two equivalents of the sulphur to one of the mercury.

Artificial cinnabar is in the form of heavy, deep silvery-red, glistening, crystalline, and striated lumps, which yield, when pulverized,

a beautiful brilliant-red powder called *vermilion*. It is inodorous, tasteless, insoluble in water and alcohol, and not acted on, like the other mercurials by the alkaline chlorides. When heated in close vessels, it volatilizes unchanged, but in the air is decomposed, the sulphur undergoing combustion, and the mercury rising in vapour.

Medical Effects and Uses.—This sulphuret is thought to be entirely inert in its unaltered state. The only use made of it is for the purpose of mercurial fumigation. Being converted by heat, with access of air, into sulphurous acid and mercurial vapour, it becomes efficient in this method of application, and has sometimes been used in venereal ulcers of the throat, and in other cases requiring a very speedy salivation. In order to this effect, the vapours must be inhaled; and the obvious objection occurs, that, as the sulphurous acid must be inhaled at the same time, very unpleasant and even hazardous irritation of the air-passages might be endangered. When the object, therefore, is to introduce mercurial vapours into the lungs, the black oxide would be decidedly preferable.

But the vapours of cinnabar have also been applied to the external surface, and in this way may sometimes prove serviceable. It is especially in syphilitic eruptions that they have been thus employed; but they might also be used in any other obstinate eruption, demanding a powerfully alterative and stimulant impression. In such cases, the attendant sulphurous acid may be useful. From ten grains to a drachm or two of the cinnabar may be used, according to the extent of surface which it may be desired to affect. It may be simply placed on a plate of heated iron, which, when the application is to be general, must be introduced within a vapour bath, especial care being taken that the head of the patient shall project, and that the aperture around his neck be well closed. When the application is to be limited to a single limb, it may be introduced into a box made for the purpose, with an opening to admit the limb. It may be sufficient, sometimes, to direct the vapours upon a particular spot, by means of an instrument resembling a funnel.

II. BLACK SULPHURET OF MERCURY or ETHIOPS MINERAL.—Hydrargyri Sulphuretum Nigrum. *U.S.*

Ethiops mineral is prepared by simply rubbing mercury and sulphur together. A chemical union takes place, and a black powder results. At one time this was thought to be the protosulphuret of mercury; but, on the authority of Mr. Brande, it is now generally admitted to be a mixture of cinnabar or the deutosulphuret with sulphur.

It is a heavy, black, inodorous, and tasteless powder, insoluble in water and alcohol, and having no reaction with the alkaline chlorides. It is completely dissipated by heat.

In its operation upon the system, it is nearly if not quite inert, and might well be excluded from the officinal catalogues. It has been supposed, however, to have an alterative effect, and has, therefore, been prescribed in scrofulous swellings and cutaneous eruptions, particularly in the cases of children. The dose is stated at from five to thirty grains several times a day; but doses of several drachms have been taken, for a considerable time, with little or no effect.

6. *Officinal Salts of Mercury.*

The salts of mercury are at present scarcely used except for topical purposes. The nitrate and acetate were at one time given internally, but have been generally abandoned. Of the salts in use, I shall treat in this place only of the nitrate, in the form of the citrine ointment. The *yellow subsulphate*, or *turpeth mineral*, will be considered under the emetics and errhines, and the *solution of the supernitrate* under that of escharotics.

OINTMENT OF NITRATE OF MERCURY.—UNGUENTUM HYDRARGYRI NITRATIS. *U. S.*, *Lond.*, *Dub.*—UNGUENTUM CITRINUM. *Ed.*

According to the directions of the U. S. Pharmacopœia, citrine ointment is made by dissolving mercury in nitric acid, adding the solution to a mixture of neat's-foot oil and lard heated together to 200°, and stirring until effervescence ceases, and the ointment thickens. In the process, there is first obtained in solution a mixture of the nitrates of the protoxide and deutoxide, which are afterwards decomposed to some extent, and probably converted into the yellow subnitrate of the deutoxide of mercury; while the oils themselves are partially converted into the fatty acids, which probably combine with a portion of mercurial oxide, from which the nitric acid has been separated. The precise changes, however, have not been satisfactorily ascertained, and they differ somewhat with the circumstances of the operation. It is clear that the oxidation of the fatty matter, and the deutoxidation of the protoxide of mercury, are effected at the expense of a portion of the nitric acid, which, being thus decomposed, escapes in the form of nitrous fumes.

This ointment has a fine yellow colour when first prepared, which, however, gradually changes to a greenish hue on exposure. If well made, it retains its proper unctuous consistence for a long time. Its odour is nitrous, but peculiar.

It is irritant, and probably alterative to the surface to which it is applied, and is one of the best local remedies in chronic cutaneous eruptions requiring stimulation. The particular affections in which it has been found most efficacious are porrigo and impetigo, especially the latter, affecting the scalp and the face, in the form of tinea capitis and crusta lactea. It has also proved serviceable in the advanced stage of eczema, when the inflammation has quite subsided, and in the scaly affections, psoriasis, lepra, and pityriasis. It is, in general, not applicable to the earlier stages of these affections, and, when first used, should be considerably diluted with lard; the strength being gradually increased as the case may seem to require. If it augment the irritation, it should be suspended, and resumed at a later stage of the disease. In the affection of the edges of the eyelids denominated psorophthalmia, it is an excellent application. It may also be used, as a stimulant and alterative dressing, in foul phagedenic or indolent ulcers, particularly those of syphilitic origin.

ARSENIC.

ARSENICUM. *U.S.*—ARSENICUM PURUM. *Dub.*

I shall treat first of the effects and uses of arsenic as a medicine, and then of its several preparations. It will be understood that, in the following observations, it is not the metal in its uncombined state that will be under consideration, but those states of it, whatever they may be, in which it actually operates on the system. There can be no doubt that it is the arsenic itself which gives to all its preparations whatever peculiar efficiency they may possess, although, when quite pure, it may have but a very doubtful influence.

Arsenic has by some been ranked among the tonics; but it has always appeared to me, judging from its known effects, to be very different in its operation from those medicines, considered as a class. The antiperiodic power which it possesses in common with Peruvian bark and its derivatives, and which has mainly led to this

opinion of its character, is not specially a tonic property, and does not belong to bark itself as a tonic. The medicine which probably possesses it in the highest degree, next to the two mentioned, is opium, which certainly has no claim to be ranked with the tonics. The effects of arsenic are quite peculiar, and, in the existing state of our knowledge, it is impossible to place it in any other association of medicines than the present, without leading to false notions of its character.

1. *Effects on the System.*

In its lowest remedial doses, arsenic may often be given for a considerable time, without any other discoverable sign of its operation than the relief or cure of the disease, for which it may be administered. It is, therefore, properly an alterative. Generally speaking, however, it does produce some observable effects, which serve as a signal to the prescriber to diminish the dose, or to withhold the medicine for a time. The symptom which I have generally noticed among the first, when it is very carefully given with a special view to avoid gastric irritation, is an œdematous state of the eyelids and the cellular tissue of the face beneath them. If the medicine be persevered in, this œdema may spread considerably; and it is so common an effect as to have received the name of *œdema arsenicale*. I have met with one instance, and only one, in which this effusion appeared to extend over the body, constituting a full attack of anasarca; and in that case, which was one of intermittent fever in a boy, I was unable to determine, certainly, whether the dropsy resulted from the arsenic or from the disease, though inclined to ascribe it to the former. The œdema does not, in general, make its appearance until some days after beginning with the medicine, sometimes not for a week or ten days, or even more; and I have carried patients through a course of treatment extending to months, with the effect of curing long-continued skin affections, without any symptom of the kind, or indeed any other disagreeable symptom.

If, however, the dose be somewhat large, or the patient peculiarly susceptible, the first sign of the action of the medicine is usually presented in the stomach. Sometimes there is a slight temporary increase of appetite, such as any acrid substance may produce by its first excitant impression; but more frequently the patient complains of heat in the throat, epigastric uneasiness, anorexia, nausea, or burning pain in the stomach, and sometimes of general heat, and

more or less headache, while the pulse is somewhat accelerated; symptoms, however, which subside quickly on the omission of the medicine. Should it be persevered with, or given still more largely, the irritation of the primæ viæ is greatly increased, vomiting and purging, with griping pains ensue, and other symptoms which indicate derangement of the system at large; such as heat and dryness of skin, excited pulse, languor, weakness, wakefulness, &c. Beyond these, the effects of arsenic cannot proceed without becoming poisonous; and, as soon as the symptoms appear, the medicine should be at once omitted.

Curious accounts have been given of the use of arsenic as an habitual stimulant by the peasants of Styria, in the Austrian dominions, who are said to be invigorated by it, improving in appetite, colour, and general comfort, so as to acquire a fondness for the luxury, and to be unable to relinquish it without suffering. These statements, however, are so contrary to what has hitherto been known of its effects, that we are scarcely required to give them credence, without further authentication. Nevertheless, MM. Trousseau and Pidoux state, or rather, I presume M. Trousseau, for both authors could scarcely have performed the experiment at the same time, that after he had taken eight centigrammes (somewhat more than a grain) of arsenious acid, he felt a general excitement similar to that produced by strong coffee, with an extraordinary sense of vigour in the lower extremities, enabling him to take a long walk without fatigue. (*Traité de Thérap.*, 4e ed., i. 258.)

I have little doubt that the dangers of the medicine, and its essentially pernicious character, have been exaggerated, in the general opinion, much beyond what the exact truth will warrant. I have myself administered Fowler's solution almost or quite continuously, in alterative doses, for two, three, and even six months, without witnessing any disagreeable effects from it at the time or subsequently, but on the contrary great improvement, and not unfrequently cures of the cutaneous affections for which it was administered. On a visit to Swansea in South Wales, some years since, I was assured by respectable physicians of the place, that at the copper smelting works in the neighbourhood, which load the whole atmosphere around them with the vapour of arsenic, so that vegetation perishes in the near vicinity, and an alliaceous odour can sometimes be perceived at a considerable distance, the workmen themselves did not appear to suffer. They were somewhat paler, it is true, than the peasants of the country, but were not more lia-

ble to disease, nor shorter lived than their neighbours. Dr. Paris, in his Pharmacologia, states that, in a marshy locality in Cornwall, formerly subject to intermittent fever, it has ceased to prevail since copper smelting works have been established in the neighbourhood.

These facts may tend, in some measure, to remove any existing fears as to the safety of arsenic, used with due caution as a medicine; but they should not render the practitioner careless. If the dose is never allowed to exceed the legitimate limits, and the medicine be suspended or suitably diminished on the occurrence of any unpleasant symptom, no danger of serious injury from its use need be apprehended; but recklessness or negligence may, in the employment of this, as of any other powerful remedy, lead to irreparable mischief.

Poisonous Effects. Sometimes, when a large quantity of powdered arsenious acid is taken on a full stomach, the poison is wholly rejected along with the gastric contents, and no ill effects follow. A case is related, in which half an ounce was swallowed, with the effect of vomiting, and without causing death. But such cases are very rare. Generally, the poisonous symptoms from arsenious acid make their appearance in about half an hour, or an hour, after it has been swallowed, but occasionally in a very few minutes; and instances are on record in which they have been postponed for several hours, in one case so long as eight. A severe burning pain is felt in the stomach, usually increased by pressure; nausea comes on, quickly followed by vomiting, and somewhat later by diarrhœa; the ejected matters produce inflammation of the mucous surface over which they pass, giving rise to a sense of constriction and burning heat in the throat, with a deep purplish redness of the lips and mouth, and intense thirst; the vomiting becomes incessant, with the discharge of everything taken into the stomach; the diarrhœa is often attended with tenesmus, and occasionally with excoriations of the anus; the abdomen becomes swollen, hard, and extremely tender; sometimes the skin is hot, sometimes pale and cold, with a clammy sweat; the pulse is frequent, small, irregular, and at length extremely feeble or imperceptible; the respiration is often laboured, from the pain produced by the descent of the diaphragm; palpitations, faintness, great prostration, cramps in the extremities, and hiccough, mark the implication of the nervous system; and, finally, delirium, tetanic spasms, convulsions, and paralysis, one or all, precede the closing scene. The sufferings of the patient are often most excruciating.

Sometimes there is an itching sensation, with or without an eruption on the surface. Copious ptyalism has been occasionally observed. The urine is generally scanty, sometimes bloody or albuminous, and causes in its discharge a burning pain, which may extend to the whole genital organs, and is occasionally attended with priapism. The discharges are various in appearance, but from the stomach they are usually brown, and mixed with mucus or blood; and from the bowels are not unfrequently also bloody, and at a later period black and offensive.

Instead of the preceding symptoms, which are, for the most part, signs of an intense gastro-enteritis, the patient, in some rare instances, suffers little or no pain; even vomiting and purging may be absent; but prostration speedily supervenes, with faintness or syncope, and evidences of great nervous disorder, as delirium, coma, convulsions, or paralysis. Either the shock, made through the stomach upon the nervous centres, is so great as to prostrate the system below the point of inflammatory reaction, as sometimes happens from a violent blow on the epigastrium; or the poison is rapidly absorbed, and produces the effect directly upon the brain and heart. I am inclined to the former of these opinions.

In other cases, again, the gastro-enteritic symptoms are violent at first, but, passing off, leave the patient suffering with nervous affection, varying, according to Dr. Christison, from coma to a slight palsy of the limbs resembling that of lead, with intermediate grades of epileptic convulsion, tetanic spasm, or symptoms of hysteria or madness.

Death has taken place so early as two hours after the taking of the poison; but generally it does not occur under eighteen hours, and sometimes not for several days.

The smallest quantity, known to have caused death, is two and a half grains of arsenious acid in a stout girl, and half a fluidounce of Fowler's solution, equivalent to about two grains of the acid, in the case of a woman.

The external application of arsenic is capable of producing poisonous effects; and it has been observed that the symptoms are the same as when it has operated through the stomach, including the vomiting, purging, abdominal pains, and other evidences of gastro-enteritis, as well as those which obviously spring from the absorption of the poison. Arsenious acid has been much used as an escharotic in cancerous affections; and numerous instances have occurred, in which, under such circumstances, it has been absorbed

with fatal effect. It was at first thought that the liability to act in this way must be in proportion to the amount employed; and care was, therefore, deemed necessary not to apply it too freely to the surface to be destroyed; but experience seems to have shown, that the result is more likely to happen from small than large quantities. The more speedily and the more completely the surface is destroyed, the less will be its power of absorption, as dead flesh does not absorb; and the larger the quantity of arsenic employed, the more rapid and extensive must be the escharotic effect. It seems, therefore, that the result of experience, in this case, corresponds with what ought to be the conclusion of the judgment.

Slow Poisoning. When arsenic is taken in small quantities, repeated at intervals for a long time, a condition of slow poisoning is induced, which may eventuate fatally. This method has sometimes been resorted to by poisoners, in order to conceal their crime, by giving to the affection the appearance of a gradually increasing disease. Sometimes it is said that a gradual failure of the vital powers takes place, with loss of appetite, debility, and a general inert state of the faculties of mind and body, without any special or very obvious symptom. But I exceedingly doubt this method of operation. It seems to me quite incompatible with what I have seen of the action of arsenic, and with what is generally stated of its effects, that it should act fatally in this slow way, without producing obvious characteristic phenomena. The most characteristic symptoms are nausea and vomiting, purging, and severe abdominal pains, following on each occasion the administration of the poison. Thirst, redness of the eyes, and a cutaneous eruption, have been occasionally observed by Dr. Pereira, among the first symptoms. Ptyalism has been noticed in some instances. A chronic condition of inflammation of the alimentary canal is at length induced; furred tongue, and dryness, stricture, and burning heat in the mouth, fauces, and œsophagus are experienced; distress of stomach, with great irritability of the organ, so that everything taken into it is rejected, is not uncommon; there is usually diarrhœa, or at least looseness of the bowels, with griping pains; the pulse becomes frequent, small, and irregular; emaciation takes place; œdema of the face and limbs supervenes; and at last the nervous system becomes seriously implicated, and neuralgic pains, tremors, headache, vertigo, morbid vigilance, convulsions, and paralysis, more or less complete, indicate the slow approach of death. The fatal issue is sometimes preceded by delirium or stupor, and sometimes occurs without them,

the mind remaining unclouded to the last. A curious effect, occasionally produced by arsenic, is the falling of the hair and nails.

Appearances after Death. In those cases in which arsenic destroys life as by an overwhelming blow, no abnormal appearance has been found after death. Generally, however, there are abundant signs of inflammation of the mucous membrane of the stomach and bowels, as redness, softening, bloody effusion, ulceration, and sometimes gangrenous patches. Marks of inflammation have been found also in the interior of the heart, the bronchial tubes, the urinary passages, &c. The blood is said to be sometimes fluid and dark; but this is not a necessary or characteristic effect of the poison; and M. Flandin has seen the blood of a person poisoned with arsenic perfectly healthy. (*Taylor on Poisons*, London, 1848, p. 31.) The same evidences of gastro-enteric inflammation have been noticed, after death from the external use of the poison.

Treatment of the Poisoning. If the patient vomit, the stomach should be well washed out by the free exhibition of demulcent liquids; if not, ipecacuanha should be given, and followed by similar drinks, which serve the purpose not only of favouring the expulsive efforts of the stomach, but of involving also the undissolved particles of the poison, especially if, as is generally the case, arsenious acid should have been taken. If the evacuation of the stomach can be effected in no other way, recourse should be had to the stomach-pump. But, along with these measures, recourse should be had also to antidotes. Two substances have been proved to possess more or less antidotal powers; both, by forming with arsenious acid insoluble and inert compounds. These are hydrated sesquioxide of iron, and freshly precipitated hydrated magnesia. The former is probably most efficient; but, in its absence, the latter may be employed. Arsenious acid probably acts only as it is dissolved, which is rather slowly. The antidote combines with the dissolved portion, as fast as it is taken up by the liquids of the stomach, and before it can either act on the mucous coat, or be absorbed. But, to do this effectually, it must be used largely, so as to be present in all parts of the stomach, and be ready at every point to obviate the mischief. It is said that an amount of the chalybeate should be used, not less than twelve times the supposed weight of the arsenious acid swallowed; but it would be better much to exceed this quantity. After the stomach has been thoroughly cleansed, castor oil, or other quick cathartic, also accompanied with the antidote, should be given freely, so as to neutralize and expel any of the poison which may

have passed into the bowels. It is advisable to continue the use of the antidote for some time, in order to obviate mischief from any particles of the poison which may still cling to the mucous membrane, and which it is not always easy to dislodge. As the antidotes have no effect on the undissolved arsenious acid, they cannot at once neutralize the whole quantity in the stomach, no matter how largely they may be taken. Hence the necessity of continuing them, as long as there can be a suspicion, that any particle of the poison may still lurk anywhere in the primæ viæ. Attention must also be paid to the inflammatory and irritative symptoms, which must be combated by such measures as the circumstances may seem to call for, in each particular case; bleeding, leeching, blistering, cooling drinks, ice, &c., being employed, one or all, for the relief of the inflammation; and opium, by the mouth or the rectum, for that of the irritation. Often, however, the system is too prostrate to admit of free depletion, and sometimes it may be necessary to stimulate.

The best efforts will often fail to relieve poisoning from arsenic; and patients often die, when there is no reason to think that any of the poison remains in the primæ viæ. This may happen either from the severity of the local affection of the stomach and bowels already produced, or from that portion of the poison which has been absorbed, and is exercising its fatal energies everywhere on the tissues.

2. *Mode of Operating.*

The preparations of arsenic are locally very powerful irritants, and even caustics: upon the system their effects are also powerfully irritant, but at the same time quite peculiar, and in the end depressing.

Their first effect, when topically applied, is intense inflammation, which, if the quantity used has been sufficient, quickly ends in the death of the part. It is not, therefore, by a chemical or corrosive influence that arsenic operates, but dynamically upon the vital properties. The part perishes because it is stimulated beyond its powers of life. More will be said of the local action of arsenic under the escharotics.

When the medicine is swallowed, the first irritant or inflammatory effects on the primæ viæ would seem to be the result of a local operation, and, to a certain extent, they must be so; but, when it is considered that a similar condition of the mucous membrane is induced by its external use, the conclusion seems to me inevitable, that, even in the former case, the local effect on the stomach and

bowels must be in part ascribed to an influence upon the tissue, exerted through the system, after absorption has taken place.

That arsenic is absorbed, has been placed beyond doubt by its detection in various parts of the body, and in the secretions, after its internal exhibition. Not only has it yielded evidence of its presence to chemical tests, but the metal itself has been recovered; and these results have been obtained not in a few instances only, and in experiments on the lower animals, but very frequently, and in the human subject. It has been found in the blood, in several of the solid tissues, as the liver, spleen, gastric and intestinal coats, lungs, heart, and brain, and in the urine. It has been detected most frequently and abundantly in the liver, spleen, and urine. The viscera of those poisoned with it have yielded it to chemical examination, many years after death and interment. Orfila discovered it in the blood of a dog, in less than two hours after the poison was introduced into the stomach, and in the urine in from six to eight hours. It probably enters the system through the portal vein, and is distributed through the liver before it reaches the general circulation. Hence the greater readiness with which it may be detected in that organ. That it is found also especially in the urine, shows the disposition of the system to get rid of it through the kidneys. Yet it seems to have considerable adhesion for the tissues, or else is susceptible of but slow elimination; for it may be found in the urine for a considerable time after it has ceased to be taken, and there is no longer reason to suppose that any of it remains in the stomach and bowels. According to M. Flandin, from one to two weeks elapse before it entirely disappears from the system, as indicated by its absence in the urine. Hence, in a person who has survived the injurious effects of an over-dose, the urine will often afford as certain evidence of its having been taken, as though it had been found in the contents of the stomach.

How arsenic operates after absorption has not been shown; and it is useless to speculate on the subject. Its effects on the pulse, skin, urinary organs, &c., prove that it is irritant as well when in the blood as elsewhere; but the symptoms of depression, faintness, and great prostration which it also often very speedily induces, would seem to indicate that it has a directly prostrating power on some of the great vital organs, or at least that its irritant effects are so prompt and powerful as to overwhelm them. That it has no special tendency to act on the lobes of the brain, is shown by the clearness of intellect which not unfrequently remains, almost to the

last moment, in cases of poisoning. There is no proof that it operates by producing any change either chemically or vitally in the blood; for, though this has sometimes been found fluid and black, the same result often happens when the respiratory process is fatally interfered with, and does not uniformly happen in cases of arsenical poisoning; the blood being sometimes, to all appearance, perfectly healthy.

3. *Therapeutic Application.*

The two sulphurets of arsenic, orpiment and realgar, were employed by the ancient Greek and Roman physicians, and after them by the earlier Arabians; but they seem to have subsequently fallen into neglect; and, though the arsenicals still lingered in popular and empirical practice, and were occasionally used by regular physicians as external remedies, it was not till the seventeenth century, that their employment can be said to have revived among the moderns. In the mean time, arsenious acid or white oxide of arsenic had been discovered, and it is this that seems to have been mainly used, under the name of arsenic, at the period of the revival; having been found more efficient and reliable than the native sulphurets. It was prominently as a febrifuge, that the medicine was now recommended internally. Hadrien Slevoght, a professor at Jena, who treated of arsenic in a work published in 1700, appears to have been the first writer of standing who recommended it in intermittent fever. It soon came into considerable vogue in Germany; but Störck, who introduced so many vegetable poisons into use, seems to have taken a bitter prejudice against this one of mineral origin, and had influence enough, aided by the known dangers of the medicine, and probably by the occurrence of serious consequences from its excessive or careless use, to cause its almost entire banishment once more from regular practice. To Dr. Thomas Fowler, of England, we are indebted for again bringing the remedy into favour with the medical profession, by a treatise entitled *Medical Reports on the Effects of Arsenic*, published in 1786. His name has been perpetuated in the preparation of the metal, now generally used, at least in Great Britain and the United States, when it is wished to bring the system under its remedial influence.

The most important remedial uses of arsenic are those connected with its antiperiodic power, and its alterative influence in chronic skin diseases, chronic rheumatism, and certain nervous affections.

1. *Uses of Arsenic as an Antiperiodic.* Next to Peruvian bark and its derivatives, arsenic is, I believe, generally admitted to be the

most efficacious remedy in regularly periodical or intermittent diseases.

In *intermittent fever*, it has been much used, and with great success. As well from my own trials with it in the earlier period of my professional life, before quinia had come into use, as from the testimony of others, I believe that arsenic is adequate to the cure of intermittent fever in a very great majority of cases, and, indeed, that few will resist it if judiciously employed. It is not, however, so prompt in its effects as sulphate of quinia, at least in the doses in which it is quite prudent to employ it, and does ordinarily fail in a certain number of cases. These considerations have led to its general abandonment as the primary remedy in the disease; though it is still occasionally resorted to, when, from any cause, the preparations of Peruvian bark cannot be given, or fail of the desired effect. In some instances of old intermittents, in which quinia has been given often and largely, the system seems at length to lose in great measure its susceptibility to the influence of that medicine, which can, therefore, be no longer advantageously used, until a temporary abstinence shall permit a return of the susceptibility. Quinia is also believed, by the advocates of arsenic, to leave a greater tendency to relapse behind it. Under these two conditions, then, arsenic becomes a most valuable remedy in intermittents; to wit, when the susceptibility of the system to quinia has been much impaired, and when frequent and annoying relapses occur, which it has been found powerless to prevent. In young children, moreover, it has the advantage of being tasteless, or nearly so, in the form usually employed. One reason of the want of success, which some have complained of, is probably the use of insufficient doses. To interrupt the disease, it is necessary to make a strong impression, whatever may be the medicine used, whether quinia, opium, or arsenic. Before the proper management of quinia was well understood, failures with it were very common, in consequence of the smallness of the doses. As much of the arsenic should be given at first as the system will tolerate; and the dose may be diminished as soon as signs of its operation are obtained, care being taken that it should not be permitted to irritate the stomach. It was upon this plan that our countryman, Dr. Thomas Mitchell, formerly of Philadelphia, met with extraordinary success in the use of the remedy, so long since as the year 1820; and that, more recently, M. Boudin, of France, has obtained such astonishing results. In the hospitals of Marseilles, Versailles, and Paris, M. Boudin treated nearly 4000 cases of inter-

cannot be given, and the stomach is not irritated or inflamed, the physician would be justified in having recourse to arsenic. The same may be said of remittent neuralgia; that is, a form of the disease in which a violent paroxysm of pain recurs at a certain time every day or every other day, with a moderated degree of pain in the interval.

2. *Use in Reference to its Alterative Properties. Chronic cutaneous eruptions* are the affections in which arsenic exercises its most valuable powers; and, so far as my observation has gone, there is no other single remedy which equals it in efficiency, not even mercury, if the syphilitic eruptions be excepted. It may be said, as a general rule, to be applicable to all cases of obstinate disease of this kind, not arising from exclusively local causes, when unattended on the one hand, with general febrile or local inflammatory excitement, or on the other, with a depraved and cachectic character of the system, anemic state of the circulation, or anasarcous tendencies. Under the latter circumstances, the attempt should first be made to restore the general health, after the attainment of which object, should the eruption not give way, arsenic may be employed. But, though thus generally applicable, there are particular forms of the affection which yield more certainly than others. In the *scaly affections*, especially *lepra* and *psoriasis*, I consider arsenic as an almost sovereign remedy, when properly used, and in connexion with certain other measures to be indicated directly. Under my own care, cases of long standing, and of the most inveterate character, have uniformly yielded, in a period of time varying from two to six months. In one case of psoriasis, in which the eruption had continued fifteen years, had extended over the whole body, except the palms of the hands and soles of the feet, and in the lower limbs consisted of one thick scaly incrustation, leaving no portion of sound skin visible, the patient recovered completely and permanently in six months. The method which has been most successful, in my hands, is to begin with very small doses, so as in no degree to disturb digestion, and to persevere with these continuously, somewhat increasing them if no effect is produced, and diminishing them upon the occurrence of gastric disturbance, for whatever period of time may be necessary to produce a cure. I usually begin with three drops of Fowler's solution three times a day, increasing if necessary to five or seven drops, but not often exceeding the latter quantity. But, at the same time, I use the officinal *decoction of dulcamara*, in the dose of a wineglassful three

or four times a day, and a *warm mucilaginous bath*, as of bran for example, every day; and, as soon as the tendency to fresh eruption has ceased, or very materially diminished, apply the *tar ointment* locally, first upon a single limb, and afterwards upon successive parts, until the eruption wholly disappears. My reason for thus postponing the local measure is that, while the constitutional tendency exists, showing itself by fresh eruptions, there would be danger of an introversion of the irritation upon some vital organ, should the cutaneous affection be suppressed; and it is on similar grounds, that I use the local remedy only on a portion of the affected surface at once. The *ointment of iodide of sulphur* has sometimes also answered a good purpose; but on the whole I prefer the tar ointment. Whether the arsenic would effect the cure without these adjuvants I am not prepared to say, for I have never tried it unassisted; but this much I can state with great confidence, that it constitutes an essential part of the treatment. In *pityriasis* I do not feel an equal confidence of success, though, in the ordinary forms of the disease, it would probably effect cures. In the *P. versicolor*, which I believe to be an exclusively local affection, dependent on a special cause, and curable by local applications, it is probably useless. Nor can much reliance be placed upon it in *ichthyosis*, which is too often incurable. Still, I should expect more from the above combination of measures than from any other, in this disease.

Chronic eczema and impetigo, after the subsidence of all inflammatory excitement, are perhaps next in the order of cutaneous affections in which arsenic is most useful. They will, however, very often get well without arsenic; and it is only in cases of extraordinary obstinacy that the remedy is advisable.

But it is unnecessary to particularize the several eruptions; as the general rule above mentioned is applicable to all; those essentially incurable by constitutional means, as the two forms of elephantiasis, keloid, and molluscum, being excluded. *Psora*, *porrigo* or *favus*, and *trichosis*, having their origin in parasitic growths, either animalcular or fungous, and being therefore essentially local, do not come within the general category.

It has often occurred to me that, upon the same principle as the one upon which arsenic is so useful in the different forms of chronic cutaneous irritation, it might prove not less serviceable in *obstinate chronic inflammations of the mucous membranes*, whether of the *respiratory*, the *alimentary*, or the *urinary passages*. But I confess that I have never carried the conception into full execution. Arsenic,

however, is not altogether without reputation in chronic bronchial inflammation; and Dr. Simpson, of Edinburgh, has employed it in a certain very obstinate affection of the bowels, not uncommon in that city, under the impression that it was a kind of internal eruption.

Chronic rheumatism, of a certain kind, may often be beneficially treated by arsenic. The variety in which it proves most useful, is that in which there is vague pain, supposed to be in the bones, without local swelling, except that of the periosteum constituting nodes. This is most commonly found connected with syphilis; but it sometimes also occurs under circumstances which do not justify us in ascribing it to that origin. Of late, iodide of potassium has been found so effectual in this disorder, as to have almost superseded the use of arsenic; but, should the former remedy fail, the latter may be resorted to.

Another variety of the disease, in which Dr. Christison, in his Dispensatory, speaks of it as peculiarly efficacious, is that in which the joints of the fingers are affected with firm swellings. He ascribes to Dr. Haygarth the first suggestion of this special application of the remedy.

Nervous diseases have been referred to above as among those in which arsenic has been used for its alterative powers. The one in which it is probably most efficacious is *chorea*. By some practitioners it is considered as an almost sovereign remedy in that affection. Having found other measures very effectual, I have not employed arsenic, but have no doubt of its remedial powers. Dr. Ferriar found it useful in *hooping-cough*, after the cessation of the inflammatory symptoms. In *epilepsy* it has also been tried, and as asserted, with some success; but there are few practitioners who would at present be disposed to place much reliance upon it in that complaint. In *tetanus*, in which it has also been used, experience has not pronounced in its favour; and the disease is too rapid and violent, to allow us to expect advantage from any degree of impression upon the system, which it would be quite safe to obtain from arsenic. I have already referred to its use in the intermittent and regularly remittent forms of *neuralgia*. It is also among the remedies used in irregular forms of that affection, and occasionally it proves serviceable, especially in *nervous headaches;* but it cannot be relied on. It is said sometimes to have relieved *angina pectoris*, which may be ranked among the neuralgic affections.

There are other diseases, in the treatment of which arsenic has had more or less credit. It has been deemed a remedy for the poisonous effects of *snake-bites;* but little reliance is placed upon it. *Asthma*, *phthisis*, *secondary syphilis*, *dropsical diseases*, the *advanced stage of typhus fever*, *certain ill-conditioned ulcers*, *lupus*, and *cancer*, are complaints in which it has been used with more or less supposed advantage. In *pectoral affections* it has been used by way of inhalation, for which MM. Trousseau and Pidoux recommend cigarrettes prepared in the following manner. From thirty grains to a drachm of arsenate of soda is to be dissolved in three drachms of distilled water. A piece of paper is to be saturated with this solution, then dried, cut, and rolled into the form of little cigars. Each cigar may contain one or two grains of the arsenical salt. They are to be smoked like the similar preparation of tobacco; the patient slowly drawing the smoke into the bronchia, and repeating the inhalation four or five times; and the process may be performed three or four times a day. In this way, the authors have employed arsenic with great alleviating effect in *phthisis*, and with much greater advantage in simple chronic *laryngitis* and *bronchitis*. (*Op. cit.*, i. 267.)

In some of the external affections above referred to, arsenic is also employed topically. But of its use in this way, the proper place to treat will be under the escharotics, to which the reader is referred.

Contraindications. Arsenic should not be employed in states of high febrile or inflammatory excitement, in any case in which the stomach is inflamed, or in cachectic conditions of the system with weak pulse, defective appetite, depraved or anemic blood, and a disposition to dropsy.

4. *Preparations of Arsenic.*

The metal itself is not used in medicine. Though capable of producing poisonous effects from its facility of oxidizement, it is too uncertain to be relied on. *Realgar* and *orpiment*, the former called *red sulphuret* or *bisulphuret of arsenic*, and *sandaraca* by the ancients; the latter, *yellow sulphuret* or *tersulphuret of arsenic*, and *auripigmentum* or *arsenicum* by the ancients, though employed by the old Greeks, Romans, and Arabians, and occasionally by the moderns, have now been abandoned in regular practice, as less efficient and more uncertain than arsenious acid and its compounds. The preparations now most in use, at least wherever the English

language is spoken, are arsenious acid and the officinal solution of arsenite of potassa, commonly known as Fowler's solution. Some others are occasionally used, which will be noticed.

I. ARSENIOUS ACID.—ACIDUM ARSENIOSUM. *U. S., Lond.* ARSENICUM ALBUM. *Ed.*—ACIDUM ARSENIOSUM PURUM. *Dub.* *White Oxide of Arsenic.—White Arsenic.*

This is obtained in roasting the ores of other metals containing arsenic. It is condensed in the flues, collected, and refined by sublimation.

Properties. As first procured, it is in beautifully transparent, glass-like, colourless or slightly yellowish masses, which, however, gradually become white and opaque, so as to resemble white porcelain or enamel; the change commencing at the surface, and gradually penetrating towards the centre. This change is supposed by some to be merely molecular, by others has been ascribed, with greater probability, to the absorption of a minute proportion of water. In the shops, it is either in the state of fragments, which have undergone the change more or less completely, or of a fine, perfectly white, rather heavy powder. Its specific gravity is stated variously at from 3.2 to nearly 3.8 It is quite inodorous, even in vapour, and has a feeble slightly sweetish taste. Its solubility varies with its transparency, being, according to Bussy, three times as great in the perfectly transparent as in the perfectly opaque variety. Cold water dissolves but little of either, not more than one or two parts in one hundred; boiling water dissolves a much larger proportion, and, upon cooling, the solution retains considerably more than cold water will take up. The presence of organic matters diminishes the solvent power of water. The acid is soluble in alcohol and the oils. It is fusible and wholly vaporizable by heat; and, though the vapour of the acid is inodorous, yet, if the vaporization be effected in the presence of combustible matter, as by throwing the powder upon red-hot coals, a strong odour of garlic is exhaled, owing to the deoxidation of the acid; the odorous vapour being that of the reduced metal. Arsenious acid consists of one equivalent of oxygen and three of arsenic.

Incompatibles. With solution of arsenious acid, lime-water throws down a white precipitate of arsenite of lime; hydrosulphuric acid a whitish, and soluble sulphurets a yellow precipitate of sulphuret of arsenic; ammonio sulphate of copper, a green precipi-

tate of arsenite of copper; and ammonio-nitrate of silver, a yellow precipitate of arsenite of silver. In relation to the means of detecting arsenious acid for medico-legal purposes, the reader is referred to works on chemistry and toxicology. He will find them accurately stated by Dr. Bache in the U. S. Dispensatory.

The effects of arsenious acid on the system, and its other medicinal relations have been already sufficiently considered. The *ordinary dose* is one-twelfth of a grain twice or three times daily, which may be diminished or increased according to circumstances before stated. It may be given in pill, made with the crumb of bread; very great care being taken to diffuse the arsenical preparation equally through the mass, for which purpose it should be well rubbed in a mortar with powdered gum arabic or sugar, before being incorporated with the crumb. A safer method, however, of administering the medicine is in solution, especially when it is to be continued long; as in this state it will be less liable to accumulate, and thus at any time to operate with unexpected violence. The most convenient solution is the officinal one to be noticed immediately. Should the medicine irritate the stomach or bowels, it may sometimes be advantageously combined with a little opium; but, as a general rule, the occurrence of such irritation should be a signal for diminishing the dose, or suspending the medicine. It is best administered when there is some food in the stomach, as it may thus be slowly absorbed into the system, with less opportunity of irritating contact with the gastric mucous membrane.

II. SOLUTION OF ARSENITE OF POTASSA.—LIQUOR POTASSÆ ARSENITIS. *U. S., Lond.*—LIQUOR ARSENICALIS. *Ed., Dub.*—*Arsenical Solution.*—*Fowler's Solution.*

This excellent preparation of arsenic is made, according to the directions of the U. S. Pharmacopœia, by boiling sixty-four grains of arsenious acid, and the same quantity of pure carbonate of potassa with twelve fluidounces of water, till the acid is dissolved, then adding half a fluidounce of compound spirit of lavender, and afterwards sufficient distilled water to make exactly a pint of the solution. The arsenious acid unites with the potassa of the carbonate, the carbonic acid of which escapes, so that the resulting liquid is simply a solution of arsenite of potassa, slightly coloured and flavoured with compound spirit of lavender. This is important; as the pure solution, without some flavouring addition, might be readily mistaken for water, with very serious consequences. The

preparation was introduced into use by Dr. Fowler, who contrived it as a substitute for a patented medicine, which had been previously in use under the name of *the tasteless ague drop.*

The solution is transparent, and of the colour and flavour of compound spirit of lavender. It is decomposed by the substances already mentioned as incompatible with solution of arsenious acid. It is the preparation now almost universally preferred for obtaining the effects of arsenic on the system; and, in my own practice, I have found occasion for no other. It contains half a grain of arsenious acid in each fluidrachm; and consequently ten minims, or about the same number of drops is the medium dose, to be taken twice or three times daily. The dose may often be lowered to three drops, or increased to fifteen or twenty with advantage. The same rule as to the suspension or diminution of the dose, given at any particular time, is applicable to this preparation as to arsenious acid; but there is less danger of accumulation than with the latter. The dose for children should be proportioned to the age, according to the general rule. (See *vol.* i., p. 35.)

III. SOLUTION OF IODIDE OF ARSENIC AND MERCURY.—LIQUOR ARSENICI ET HYDRARGYRI IODIDI. *U. S.*—ARSENICI ET HYDRARGYRI HYDRIODATIS LIQUOR. *Dub.*—*Donovan's Solution.*

This preparation, originally suggested by Mr. Donovan of Dublin, has been officinally recognized in the United States and Ireland. The U. S. Pharmacopœia directs it to be made by dissolving thirty-five grains of iodide of arsenic, and the same quantity of red iodide of mercury, in half a pint of distilled water. The iodide of arsenic is prepared for the purpose, by first rubbing together one part of metallic arsenic and five parts of iodine, and then gently heating the mixture till it melts. It is a teriodide, consisting of one equivalent of arsenic and three of iodine.

The object in this preparation is to obtain the conjoined effects of the three powerful alteratives, mercury, arsenic, and iodine. It is employed chiefly in obstinate chronic skin diseases, in which it has proved highly successful. As with the other preparations of arsenic, it should be used, in these cases, in small doses, and for a long time. It may, however, be doubted, whether the separate exhibition of these energetic medicines would not answer an equally good purpose, without being liable to the same objection; namely, that the exhibition of the solution must be regulated by the influence of that one of its three components which acts most speedily

and powerfully on the system. If any one of the three produce untoward effects, the whole must be withdrawn or diminished. The strength of the solution is such that twenty drops "contain the twenty-fourth of a grain of arsenious acid, a little over the twelfth of a grain of the deutoxide of mercury, and about a quarter of a grain of iodine." (*U. S. Dispensatory.*) The dose is from five to twenty drops three times daily. The solution is sometimes also used topically in obstinate eruptions and ulcerations, being diluted with an equal bulk of water.

The compounds of *arsenic acid* have also been used—as the *arsenates of potassa, soda, ammonia, and iron;* but they have no advantage, as arsenical preparations, over the arsenious acid and solution of the arsenite; and, in reference to the arsenate of iron, it would be better, in cases in which its two ingredients may be indicated, to employ them separately; as we should thus be guided in the dose of each by the wants of the case, and not by the rigid limits of chemical affinity.

III. IODINE.

IODINIUM. *U. S., Lond., Dub.*—IODINEUM. *Ed.*

I shall treat first of the effects of iodine and its preparations on the system, and of their therapeutic uses, and afterwards of the different forms in which the medicine is administered. In the outset, it may be proper to say that, as iodine, after entering the circulation, always probably exists in a state of saline combination, it is not the element itself to which the effects are immediately attributable, but its salts; and hence the identity of the general influence exerted by its different preparations.

1. *Effects upon the System.*

The local effects of iodine and its preparations are more or less irritant, and, in this respect, the elementary substance is more energetic than most of its compounds. When iodine in solution is applied to the skin, it causes a deep orange-yellow or brown discoloration, which, however, often disappears without desquamation, either through the slow evaporation of the medicine, or the agency of emollient or demulcent substances. This would seem to show, that it is rather a mere imbibition than chemical combination which takes place; yet, if the application is made very freely, the epider-

mis seems to be chemically altered, and, under such circumstances, always exfoliates. Inflammation, and, in the highest degree of its action, even a corrosive or escharotic effect, may result from the local use of iodine, especially when in contact with the mucous membranes. Most commonly, when ulceration or sphacelus has occurred, it has probably been the result of a dynamic operation, causing the death of the part through an over-exaltation of its actions; but it is not impossible that, in consequence of the strong affinity of iodine for hydrogen, it may sometimes abstract it from the tissues with a disorganizing effect. The irritant effect of iodine may result from its application in any form, whether solid, liquid, or aeriform, especially to the mucous surfaces.

Iodine often exercises a most happy influence in the cure of disease, in doses which produce no other evident sign of their operation, and which are insufficient to disturb health in any discoverable degree. It is, therefore, eminently an alterative medicine.

Given in such quantities as to make its action sensible, it not unfrequently at first somewhat increases the appetite; but this is an effect which it produces in common with most other irritants, and which, if the dose is increased, passes into positive irritation, as evinced by gastric uneasiness, nausea, and some disturbance of the bowels, with or without colicky pains. A very common result of its continued use, even when no obvious irritation of stomach is produced, is soreness of throat, or some degree of inflammation of the air-passages. This may, indeed, be considered as one of the best practical signs of its operation on the system, and, when exhibited, should lead to a temporary suspension of the medicine, or a diminution of the dose. Some degree of headache, or frontal uneasiness, is also not a very uncommon symptom. When the system comes fully and obviously under its influence, the pulse becomes more frequent, the warmth of skin is increased, the stomach is disturbed, the tongue furred, the head often uneasy; in short, a moderate febrile state is produced, which springs from the simply irritant influence of the medicine, not only in the primæ viæ, but on the system at large through the circulation.

Even under a less degree of its action than is required to produce this febrile state, it exhibits a disposition to increase the secretions. Perhaps there is no one of the secretory functions which is not occasionally stimulated, and yet no one so steadily and prominently, that the medicine can be said to have any special predilection. The skin, the mucous surfaces, the kidneys, the liver,

and the salivary glands are more or less excited, one, or another, or more than one, probably according to incidental circumstances which may give the medicine some preferable direction. Almost all writers agree in the statement, that the menstrual function also is stimulated. Occasionally, though rarely, profuse salivation has been noticed. In some instances, an effect has been produced on the mouth similar to the mercurial; but there is every reason to suspect that, in these cases, it was really an effect of mercury, liberated through the influence of the preparation of iodine from an inert condition, in which it had for a longer or shorter time remained in the tissues.

The medicine is said occasionally to produce peculiar effects on the skin. Thus, an embrowned state of the surface, which has in one or more instances followed its use, has been ascribed to it as the cause. But the justice of this ascription may be doubted, when we consider how rare has been the coincidence, and yet how frequently such discolorations have occurred, without any known connexion with iodine in any way. What is more certain is, that the medicine occasionally gives rise to eruptions on the surface, *erythematous*, *papulous*, *eczematous*, or *impetiginous*, which, however, have nothing serious in them, and yield readily on the suspension of the medicine. Iodine produces this effect in common with many other irritants of the alimentary mucous membrane, and of the general system, as copaiba and the turpentines; and there is nothing specific or peculiar in the result. Nor is it common. I have very rarely seen it, though very frequently prescribing iodine to hospital patients.

Absorption is said also to be promoted by iodine; and, in proof of this opinion, the facts are advanced that, when long continued, it produces general emaciation, and occasionally shows a disposition especially to attack the mammæ and testicles, and to cause atrophy of these glands. But, in reference to the emaciation, this, I believe, is never induced by the insensible operation of the medicine, and, when it occurs, can readily be explained by the impaired digestion, and otherwise disordered state of the system, resulting from its irritating influence. As to the devastation which it was at one time supposed to produce in the glands specially referred to; this has come to be regarded as one of the apocryphal facts of medicine. So many thousand physicians have now been prescribing iodine for so long a time, and such multitudes of patients have been kept under its influence for months, and perhaps years, without any acci-

dent of this kind having been observed, that there is every reason to believe, that the instances which really have occurred of this apparent effect, were in fact simply coincidences. The mammæ and the testicle are well known occasionally to wither, under other influences; and, if iodine had any special power of promoting this tendency, the fact would by this time have been established beyond doubt. Instead of this general and partial wasting, which, in the earlier history of iodine, were bugbears to the profession, nothing is more common at present than to see our patients enjoying good general health under its prolonged use; and even increase of weight is not uncommon. The old idea, therefore, that iodine specially promotes absorption, must, I think, be abandoned.

Sometimes the irritant action of iodine appears to be directed peculiarly to the brain, and the phenomena of nervous disorder predominate; such as neuralgic pains, headache particularly frontal, pains in the eyes and ears, tinnitus aurium, disordered vision, wakefulness, and sometimes delirium and convulsions. Lugol mentions cases of this kind, which resulted from the external use of iodine in the form of bath; so that the effects are something more than the sympathetic results of an irritated stomach. The name of *iodic intoxication* has been given to this condition. I have never witnessed other effects of the kind than neuralgic pains and headache; the latter of which is not very uncommon. I once saw an attack of exceedingly severe neuralgia, which I ascribed to the use of iodine, and which ceased after the omission of the medicine.

Poisonous Effects. These are of two kinds; *first*, those which proceed from a prolonged use of iodine in excess; and *secondly*, those occasioned by an excessive dose at once. Both, I believe, are the result of irritation, produced either in the primæ viæ, the system at large, or the two jointly.

The name of *iodism* has been given to the state of system, resulting from the repeated or prolonged exhibition of the medicine in undue amount. It is said to be characterized by vomiting and purging, one or both; abdominal pain; a general febrile state, with heat of skin, frequent pulse, and thirst; cramps in the extremities, and great emaciation, ending in death, if the cause continue to operate. Such cases are not seen now. They were probably either the result of a sustained gastro-enteritis, or mere coincidences with the use of iodine, and not effects of it. When the iodide of potassium is used largely for a long time, during whole years for example, it is said to occasion a chronic inflammation of the tongue,

by which that organ becomes enlarged, lobulated, and fissured. Several cases of this nature have been reported by Mr. Langston Parker, of England. (*U. S. Dispensatory*, 10th ed., p. 1155.)

Acute poisoning may result from excessive doses of iodine; though, when taken largely in the unaltered state, it is apt to excite vomiting, and thus obviate any very serious consequences; while in the form of iodide of potassium, in which it is more generally administered, it is very doubtful whether it can be justly considered as poisonous, at least not more so than nitre, and probably under similar circumstances. Iodine, however, either in the aggregate state, or that of alcoholic solution, is capable of producing death. This has been proved by experiments on the lower animals, and by the occasional result of over-doses accidentally taken in man. The symptoms are those of irritation and inflammation of the primæ viæ; namely, violent burning pain in the throat and stomach, intestinal pains, retching or vomiting, purging, thirst, very frequent pulse, palpitation, suffused eyes, restlessness, trembling, faintness, and prostration; and, if death does not soon take place, great emaciation. As to the quantity required to produce fatal effects, there can be no precise decision, as circumstances so much modify the result. Thus, when the iodine happens to vomit early and freely, it is less likely to cause death; and, if taken with substances containing starch, as bread or farinaceous food in general, or if the stomach happen to be full of such food at the time, it is apt to combine with the starch, and thus form a substance comparatively harmless. Orfila found that in dogs, with the œsophagus tied, a drachm of free iodine was sufficient to destroy life in a few days; while in others, in their ordinary condition, two or three drachms were required. A case of death in a woman is on record, caused by swallowing an ounce of the tincture, containing somewhat less than a drachm of iodine. (*Taylor on Poisons*, p. 304.) Orfila took four grains and a half of solid iodine, with the effect of producing heat, constriction in the throat, epigastric pains, vomiting, colic, hot skin, frequent pulse, and high-coloured urine, which yielded to emollients and diluents, leaving on the following day only a sense of weariness. Dr. Taylor thinks that fifteen or twenty grains of solid iodine might endanger life (*Ibid.*, p. 304); and no prudent physician would approach this quantity, under any circumstances whatever.

The remedies for iodic poisoning are to wash out the stomach by the copious use of demulcent drinks; to administer freely of starch either pure, or in the form of flour mingled with large quantities of

water; afterwards to clear out the bowels by a mild cathartic, also accompanied with starch; and, when the poison has been removed, to obviate irritation by opiates given by the mouth and rectum, and inflammation, if existing, by antiphlogistic measures adapted to the urgency of the case. Care must also be taken that the patient do not die of debility, from the want of nutriment.

2. *Mode of Operation.*

It has already been stated that iodine is a local irritant, and operates through this property on any surface to which it may be applied, whether the skin, the air-passages, or the alimentary mucous membrane. But it also affects the system through absorption. Of this there is no doubt whatever. Indeed, the preparations of iodine enter the circulation with extraordinary facility. It is stated that it has been detected in the urine of a dog poisoned with it, four minutes after its exhibition. It is absorbed from all the surfaces, and even rapidly from the skin, when used in the form of bath. After internal or external use, it has been detected in the blood, the solid tissues, and the different secretions, as the urine, saliva, tears, &c. The milk of nursing women contains it; and it has been found in the urine of sucklings, after administration to the mother. Readily as it finds access to the circulation, it no less readily escapes, especially by the kidneys; and the urine is that one of the secretions in which it is always sought for, when proof is wanted of its having entered the system.* It probably never enters the blood in the uncombined state; but always in the form of an iodide or iodate, or of both. A few days after its exhibition, the signs of its presence usually disappear; or at least only traces

* From an experiment of Dr. Cl. Bernard, it would appear that iodide of potassium has a strong tendency to escape with the saliva, even more so than with the urine. He injected this salt and ferrocyanuret of potassium into the jugular veins of a dog. The iodide was almost immediately detected in the saliva, and continued to be eliminated with it for several hours; while it did not appear in the urine until two hours after the injection. The ferrocyanuret, on the contrary, never appeared in the saliva, but was found in the urine about seven minutes after the injection, and remained in it so long as the experiment was continued. The experiment was repeated several times, with the same result. (*Arch. Gén.*, 5e sér., i. 6.)

While thus disposed to escape by the saliva, and after a time by the urine, it would appear, from the observations of Schottin, to be little disposed to pass off by perspiration. Though given in the quantity of half a drachm daily, it was not found in the sweat until the fifth day. (*Brit. and For. Med.-Chir. Rev.*, July, 1855, Am. ed., p. 172.)

are discoverable in the urine, which vanish wholly in a short time.

After entering the circulation, it no doubt acts as a general irritant, and hence is thrown off rapidly by the emunctories. It does not, like some of the metals, appear to form durable compounds with the tissues, or to be deposited in them in a permanent state. The facility with which it forms compounds soluble in the blood precludes such a result.

Mode of Alterative Action. But does not iodine produce other effects than those of a mere irritant? Its medicinal efficiency, in doses insufficient to produce sensible effects in health, would seem to give an affirmative answer to this question. Nevertheless, it appears to me that we can approach to a solution of the problem of its alterative action, without attributing to it any extraordinary or mysterious power. Its almost universal diffusion in nature renders its habitual presence in the system, in a certain degree, necessary in health, though not in quantities to give evidence of its existence to ordinary chemical examination. It is not at all an improbable supposition that, like chloride of sodium, it is one of the constituents of the system, favourable, if not essential to perfect health. In this view of its physiological influence, it does not seem probable that it has any special or extraordinary influence on the system, such as that of mercury, arsenic, &c., which are quite alien and repugnant to the animal economy. Its effects may, I think, be best explained, by supposing it to be a special stimulant to that function of the body by which all its parts are undergoing constant disintegration and renewal, and which may be regarded, for want of a better term, as the nutritive process. Under its influence the disintegration and renewal go on more rapidly than in health; and hence, as well as from its direct stimulant influence, may result an increase of the secretory functions in general. The results of the disintegration of the tissues must be thrown off by the emunctories as they enter the blood. Under ordinary circumstances, no emaciation takes place, because deposition takes place as rapidly as disintegration; but if digestion be interfered with by irritation of the stomach and bowels, then the waste is not duly supplied; and hence the emaciation which has been noticed under such circumstances. It will be seen, when we come to the therapeutic part of the subject, that the most beneficial and extraordinary influence of iodine may be explained on this principle. If these views be correct, the apparent increase of absorption does

not result from a direct stimulant influence on the absorbents themselves. Emaciation is not produced by increase of absorption; but the absorbents are stimulated by the increased rapidity of the disintegrating process, or dissolution of the ultimate organic structure, which affords them and the venous radicals materials for removal.

3. *Therapeutic Application.*

It is but a few years since this most valuable medicine first became known to the profession. Dr. Coindet, of Geneva, in Switzerland, has inseparably associated his name with the medical history of iodine, by having been the first to employ and recommend it. Knowing from antecedent discovery that it existed in burnt sponge, and aware of the usefulness of that remedy in goitre, he was led to suppose that iodine might be the real curative agent, and accordingly gave it a trial in the disease, which, as every one knows, is very prevalent in that region. His success fully answered his expectations; and, in a paper communicated, July 25th, 1820, to the Society of Natural Sciences at Geneva, he made known his invaluable discovery. The efficiency of the remedy in goitre naturally led to its employment in other tumefactions, especially the scrofulous; and the favourable reports made of it rapidly diffused its reputation throughout the medical world. The names of Brera, Lugol, and Manson are also favourably connected with the early history of iodine, especially in connexion with scrofula. The medicine was now experimented with in every kind of disease, and under the most opposite circumstances, and the most extravagant estimate was made of its wonderful powers. Time, however, has had its usual effect of moderating enthusiasm; and, with the advantages of abundant experience, and a cooler judgment, we are at the present day better able, than a few years since, to determine its real value, and proper position in the Materia Medica.

By far the most useful applications of iodine are those connected with its alterative properties. It is not unfrequently used for its influence over the secretory functions, and often also exclusively for its local effect. Under these three heads may be embraced all its important uses.

a. *Use of Iodine as an Alterative.*

Its efficiency in this respect is prominently displayed in the resolution of various tumefactions. In all chronic enlargements and indurations of inflammatory origin, or mere hypertrophies from

excess of the nutritive function, whatever may be the special character of the inflammation, or the seat of the tumefaction, whether in the glands, the cellular or ligamentous tissues, the muscles, periosteum, or bones, much advantage may be expected from the resolvent properties of iodine; and in such cases, there is, on the whole, no one remedy which equals it in the universality of its applicability, not even mercury. To the cure of carcinomatous, tuberculous or melanotic tumours, or other heterologous formations, or of the indurations resulting from cartilaginous or osseous degeneration, it is wholly inadequate, as indeed are all other known deobstruent remedies. It has appeared to me that its extraordinary efficiency, in the resolution of chronic tumefactions, may be best explained by the theory, already advanced, of its special influence in promoting the normal process of disintegration; of stimulating, in other words, those changes in the ultimate constituents of the tissues, which, after these tissues have run their course of service, effect their destruction and elimination, while new structure takes their place, in its turn to go through the same changes. It is generally admitted that the vital powers, in these abnormal formations, are less vigorous than in the healthy tissue, and less able to resist influences tending to their destruction. It is no violent assumption, therefore, to take for granted that their ultimate structure yields, more readily than the healthy, to the over-stimulation directed to it by the iodine; while, for the same reason, its powers of repair are more feeble. Consequently, while, in the healthy tissues, the more rapid disintegration may be supplied by an equally excited nutrition, and no change of bulk take place, the contrary is the case in the affections under consideration, which lose more than they gain, and thus return in the end to the normal state. In this view, iodine may act on them with equal efficiency, whether it is conveyed to the tumours through the circulation, or reaches them by an endosmotic penetration.

It is not, however, solely in tumefaction, that iodine proves useful. In disease of perverted action, in which an abnormal condition has been impressed upon the tissues, which prevents them from the due performance of their respective offices, and which shows itself in ulcerations, eruptions, pains, and disordered function of various kinds, the use of iodine is often followed by the most happy results. The change which it produces in the ultimate organic constituents of the tissues, causing the old to be broken up and disappear, carrying with them their abnormal tendencies, while

new and healthy structure takes their place, is very probably the source of its efficiency.

A third condition, in which the alterative powers of iodine show themselves, is one in which noxious substances, particularly the metallic, may have been deposited in the tissues, and remaining fixed there, either by their insolubility, or their affinity for the organic constituents of the tissues, keep up a constant irritation, and consequently continued evidences of morbid action. As before explained, in the articles on mercury and lead, iodine, or at least the alkaline iodides, probably act in these cases by forming soluble combinations with the foreign matter, and thus causing it to be carried off from the tissues in the current of the blood, and ultimately eliminated. For this very interesting view of the curative influence of iodine, in certain obstinate affections, the profession is mainly indebted to M. Melsens.

Having endeavoured to understand the modus operandi of iodine as a remedy, and thus to discover rational grounds for its use, we are next to consider the special diseases in which it has been found useful.

Goitre. There are few complaints in which iodine shows more extraordinary curative powers than in this. Tumours of large size, and the growth of years, will often begin to give way as soon as the system is under the influence of the remedy, and will proceed onward, in steady progress towards a cure, under its continued use. It certainly will not cure carcinoma of the thyroid gland, nor any one of those new formations or degenerations in which the normal structure has been displaced by the diseased; but in all cases of pure hypertrophy, or resulting from an obscure chronic irritation or sub-inflammation in the tissue, in other words, all cases of pure goitre, as distinguished from other special diseases which may be seated in that as well as in any other tissue, a cure may be reasonably hoped for. The cases of this disease which have most commonly fallen under my personal observation have been in young women; and these have almost invariably yielded to the preparations of iodine. The remedy should be employed both internally and topically; and I have myself preferred the iodide of potassium in both ways, giving it internally in solution, and applying it externally, in the form of ointment, two or three times daily. Not unfrequently the disease will yield to the external use of the remedy alone. Sometimes the tumour, instead of yielding immediately, seems to be stimulated into inflammation; swelling, and becoming

somewhat painful. In such cases, the local application should be omitted for a time, and replaced by emollient cataplasms, until the swelling has subsided; or a few leeches may be applied; but, after the subsidence of the inflammatory symptoms, the remedy should be resumed.

Scrofula. So far as concerns the dispersion of scrofulous swellings, whether in the glands, or elsewhere, if there has been no deposition of tubercle, and no acuteness of inflammatory action remain, iodine will prove not less efficacious, probably, than in the affection just treated of. In cases of tuberculous deposition in the glands, it is in vain to expect resolution under this or any other remedy, until the offending matter has been discharged. It is possible that the tubercle in the gland may sometimes go through a series of changes ending in its absorption, after which the swelling will disappear; but I doubt extremely whether iodine has any influence in promoting these changes. Most frequently the tubercle softens, excites suppuration, and is in this manner eliminated; but neither has iodine, as I believe, any power of forwarding this process. I have used it often in tuberculous affections; and never had any reason to suppose, in any one instance, that it had either prevented the deposition of tubercle, or facilitated its absorption or elimination. But when, as often happens, the scrofulous diathesis exhibits itself merely in the production of chronic tumefactions, the result of a low feeble inflammation, without the formation of tuberculous matter, iodine, generally or locally used, is an admirable remedy. In the indurations which sometimes remain after the discharge of the tubercle, it may also serve a good purpose by promoting complete resolution.

Even more efficacious than in mere scrofulous swellings, is this remedy often in obstinate scrofulous ulcers. It operates like a charm in many of these cases, when the ulceration seems to be kept up by a perverted tendency in the system, without the presence of tuberculous matter. The same may be said of other scrofulous affections, as of the skin, the eyes, the ligaments, even the bones and the joints, in all of which good may be hoped for from it under the circumstances mentioned. In white swelling of the joints, and in the same affection of the spinal column, whether before or after caries and suppuration, the remedy should be used, in the hope of changing the morbid action in the part affected.

I do not believe that iodine is at all competent to correct the scrofulous diathesis. By its careful use, so as rather to favour than

to impair digestion, it may contribute with other measures, such as exercise in a pure air, wholesome and nourishing food, the use of cod-liver oil, &c., to improve the general health, and thus, in some degree, to act favourably in the disease; but unassisted, it has little power, and certainly no specific power over the morbid tendencies. It is to the cure of the local affections, while other means are employed to amend the state of the system, that iodine should be specially addressed.

In scrofulous affections, iodine may be used internally, topically to the diseased part, and in the form of bath in order to impregnate the system. Peculiar care should be taken never to allow it to disturb the digestive function, or in any other way to impair the general health.

In all anemic cases of scrofula, it should be conjoined with the chalybeates; or the iodide of iron may be substituted for its other preparations.

In *phthisis*, in which much was at one time expected from iodine, and in which, from its analogy or identity with scrofula, there seemed good reasons for expecting much, I believe that it is utterly useless, so far as concerns the prevention, or the cure of tubercle. This disease so often spontaneously halts for a time in its march, and gives such fair promises of amendment, that nothing has been more common than to ascribe efficiency to medicines, which may have been administered at the time of the change; and hence a great number of supposed remedies have acquired a temporary reputation in its treatment. Iodine is among them. As it is incompetent to correct the scrofulous diathesis, so is it also equally inadequate to the prevention or the cure of phthisis; and all that can be expected from it is to correct incidental local affections, similar to those attendant on external scrofula, when not dependent on the immediate presence of tuberculous matter.

In *tabes mesenterica*, or enlarged mesenteric glands, and in a similar affection of the *bronchial glands*, good might be anticipated from it in a simple condition of chronic scrofulous inflammation without tubercles; but as, when these affections are obvious, more especially the former, they are very generally associated with this abnormal deposit, the remedy will as generally fail. Nevertheless, it may be resorted to in all cases, in the hope that the affection may be uncomplicated; while, if it be tuberculous, no injury will be done. The remedy may, in these cases, be employed in the form of bath, with special propriety.

In *tuberculous peritonitis* and *meningitis*, though the remedy has been recommended in the latter affection, it is utterly useless. I have employed it in some instances, but have never had reason to suppose that it was of the least service.

Syphilis. In the advanced stage of this affection, iodine is undoubtedly often very serviceable. It is peculiarly useful in that special condition of the disease, characterized by vague pains in the limbs, or as the patient expresses it, in the bones, with or without periosteal tumours or nodes. We often see this affection, after torturing patients for months, yield with the utmost promptitude to iodide of potassium. In the Pennsylvania Hospital, which receives the sick seamen of the port of Philadelphia, I constantly encounter this affection, and as constantly see it yield in the course sometimes of a few days, generally of from two to six weeks, to the iodide of potassium, given in the dose of five grains three times a day. It is no doubt also often adequate to the cure of the eruptive and ulcerative affections of secondary syphilis; but here its influence is less certain, and it will generally be found to operate most effectually with the aid of mercury; the auxiliary being, in my apprehension, the most efficient agent of the two.

Rheumatism, both chronic and neuralgic, sometimes yields happily to iodide of potassium. It has seemed to me to be specially efficacious in those vague rheumatic pains, resembling the affection just treated of as constituting one of the features of old cases of syphilis. I have often seen it effectual in such instances, when there was no reason to suppose that the affection was in any way connected with that disease. It may be tried in other forms of the disease, among the alterative remedies to which we are often driven, one after another, by the obstinacy of the complaint, and the impatience of the sufferer; and sometimes, almost unexpectedly, it will seem to do much good; but it cannot be depended on.

Chronic cutaneous eruptions are also among the complaints in which iodine is often used as an alterative. Though much less effectual in these complaints than either arsenic or mercury, it sometimes appears to be useful, and may be resorted to in connexion with the other alteratives mentioned, or in cases in which they may be forbidden. But more may be expected from the topical application of iodine, in these affections, than from its internal use. It may be employed, according to varying circumstances, in the form of a bath, of a lotion, or an ointment. There are few local applications more efficacious, in chronic skin diseases, than the ointment of iodide

of sulphur. I consider it second only to the tar ointment. When the affection is very general, the iodine bath may be preferred. In strictly local cases, the tincture of iodine will often be found extremely effectual, sometimes putting an immediate end to the complaint. It requires, however, to be used with caution, when the eruption is a mere symptom of a constitutional affection. Of the great use of tincture of iodine in superficial inflammation, I shall have occasion to treat in another place.

In poisoning from *mercury* and *lead*, particularly the latter, iodide of potassium is an admirable remedy, operating apparently by displacing the metal lodged in the tissues, and then causing its elimination. (See *vol.* i., *p.* 151.) Some are disposed to ascribe its efficacy, in the form of rheumatism above referred to, connected often with periosteal swelling, to this mode of action; believing that the affection is a kind of mercurial disease. I cannot believe this, until I find proofs, by the discharge of the mercurial by the kidneys, or by the evidence of its peculiar influence on the system, when liberated from its confinement, and admitted into the circulation, that mercury really did exist in the tissues. It has not been my lot to meet with this affection directly traceable to mercury; though few persons have, I presume, in this community, administered it in a larger number of cases than myself. Still, I have no doubt that there are cases of chronic mercurial poisoning, in which the iodide of potassium may be advantageously administered. (See *Mercury, page* 242.) The medicine has been given, with supposed advantage, in cases of acute mercurialization; and, upon theoretical grounds, it should operate not less efficiently here than in the chronic cases, by eliminating the offending cause, supposing that the whole of the mercurial used has been absorbed, or evacuated from the bowels.

In lead poisoning it seems, from the reports made in its favour, to be among the most effectual remedies at our command. In these cases, evidence of its efficiency has been given by the appearance of lead in the urine shortly after its employment. It is applicable to the treatment alike of colica pictonum, and the more chronic poisoning exhibited in lead palsy.

Anomalous tumours and ulcers, of an obstinate character, generally offer an indication for the use of iodine. The ulcerative affections of the mouth denominated canker, and those of the surface which accompany ecthyma, rupia, lupus, &c., may often be most usefully treated with iodine, or its preparations, internally or locally, or in the two methods jointly. In that form of *alveolar*

periostitis, which is attended with ulceration about the teeth, and their ultimate loss, it is said to have effected cures. It might even be tried in that fatal affection sometimes taken by man from horses, and usually called *glanders*. A well-marked case of the disease in a horse is said to have ended favourably, under the tincture of iodine given internally in large doses. It may be used in *chronic enlargements of the liver*, *spleen*, *uterus*, and *ovary*, and in anomalous tumours forming in the *mesentery*, with some hope of benefit. It will, in the great majority of these cases, fail to be of any service; but sometimes the swellings disappear under its use, and it deserves a trial in all cases not absolutely desperate. Here it may be used both internally, and by extensive friction over the surface of the abdomen with the ointment. Under the impression of its resolvent powers, it has been recommended in the advanced stages of *pneumonia*, and in the *chronic forms of that disease*, when the hepatized or consolidated lung is little disposed to resolution. I have used it occasionally, with doubtful advantage.

Fibrinous Exudation. Iodine is supposed by some to have an antiplastic effect upon the blood, and therefore to be useful in that kind of inflammation which tends to the formation of false membrane. We have no sufficient evidence of its possession of such a property; and, judging from its beneficial effects in certain ulcers which exhibit anything else than a tendency of this kind, I should be disposed to a contrary inference. Nevertheless, I have attended in consultation with Dr. Griscom, of this city, a case of what appeared to be pseudomembranous croup, in which the patient recovered under the use of two grain doses of iodide of potassium, exhibited at short intervals, I think of not more than two hours, for days together. When first called to the child, I found him under this treatment, and it was not altered.

b. *Use of Iodine as a Stimulant to the Secretions.*

Dropsy has been treated with the preparations of iodine, under the impression of its power of promoting at the same time secretion and absorption; but, in neither of these respects is it sufficiently energetic to meet the requisitions of that disease; and experience, therefore, has not pronounced in its favour. But dropsy is so often connected with, and dependent on affections which iodine is calculated to relieve, that the remedy sometimes proves secondarily very useful. Thus, when enlarged liver or spleen, or other abdominal tumour, or chronic disease of the valves of the heart dependent on organized fibrinous exudation, is at the foundation

of the dropsical effusion, iodine may be looked to with some hope of benefit. Cases have been recorded, in which the disease, when dependent on hepatic engorgement, has yielded to this remedy.

In *various affections of the urinary organs and passages*, iodine would seem to be indicated by the facility with which it passes out by the kidneys. Impregnating the urine, it is brought into direct contact with the diseased surface, in the chronic affections of which it may operate usefully, as a gentle stimulant at least, if not as an alterative. Thus, it has been used with asserted success in gonorrhœa, and I have no doubt that it would occasionally prove useful in chronic inflammation of the pelvis of the kidney and of the bladder, especially when attended with ulcerations. Indeed, in the latter condition, unconnected with calculi, it would probably be among the most effective remedies. In *leucorrhœa* also it has been used with supposed advantage; but, in this affection, its beneficial influence must proceed rather from an alterative impression on the diseased and perhaps ulcerated uterus, than from impregnation of the urine.

Amenorrhœa. Strong testimony is borne to the efficiency of iodine in this disease. When connected, as it frequently is, with anæmia, either the iodide of iron should be used, or perhaps preferably a milder chalybeate, such as the powder or protocarbonate of iron, with one of the milder preparations of iodine.

c. *Local Use of Iodine.*

In all the local affections above enumerated, as requiring the constitutional impression of iodine, it may also be applied topically, in some one of the various forms which will be described among its preparations. In these cases, the object of the local employment of the remedy, is to aid in obtaining its alterative influence, through the constitution, upon the diseased tissue. But iodine is often also used with a view exclusively to its local effect. This may be considered as simply irritant, or as jointly irritant and alterative. Another principle upon which the medicine operates locally, especially when the tincture is employed, is so to affect the epidermis, as to exclude the influence of the air; but more will be said on this point hereafter. In one or more of these methods, it is very useful in various *cutaneous eruptions*, for rendering the eruption of smallpox abortive, in chronic inflammation of the fauces, in chronic enlargement of the tonsils, in strumous inflammation of the eyes, in which it is applied to the lids, and in various superficial cutaneous inflammations, as *erysipelas*, *chilblains*, *scalds*,

burns, &c. In *subcutaneous inflammations* also, of various character, it has been used with more or less advantage; as in ordinary *phlegmon* and *furuncles*, *swollen bursæ*, *paronychiæ*, *swellings about the small joints*, and even in more serious affections, such as external *inflammatory swellings about the larger joints*, *whether ordinary or rheumatic*, *gouty inflammation*, &c. The same treatment has been extended to large serous accumulations, as *hydrocele*, *ovarian dropsy*, and even *ascites;* and it is not uncommon at present to use iodine externally as a rubefacient in internal inflammations, as laryngitis, bronchitis, pleurisy, peritonitis, &c., in the very commencement, or in their advanced stages. In all these cases, it is the tincture that is employed; and this is applied to the outer surface. (See the article on *Protectives.*)

Another local use made of iodine is to change the condition of secreting serous surfaces by direct contact, so as to obviate the tendency to excessive secretion. For this purpose, one of the tinctures, more or less diluted, is injected into the serous cavity. In this way, iodine has been used happily for effecting the radical cure of *hydrocele* and *ovarian* dropsy; and the idea has been practically extended to the pleural and peritoneal cavities, and those of dropsical joints. Considerable success has been claimed for this treatment in *empyema.* It has also been employed in abscesses indisposed to heal. For the modes of using the tincture in these cases, see the *tincture* and *compound tincture of iodine.*

Dr. D. Brainard, of Chicago, has suggested the local use of iodine as an antidote to the poison of serpents, having found *woorara*, which he supposes to contain poison extracted from serpents, to be neutralized and rendered inert by admixture with iodine. The plan is to apply a cupping-glass over the wound, and then to inject into the tissues around it, through minute incisions, an aqueous solution of iodine with iodide of potassium, so as completely to infiltrate the tissue. (*Essay*, &c. Chicago, 1854.) Dr. E. Harwood, in a communication to the *N. W. Medical and Surgical Journal*, states that he applied the tincture of iodine in a case of snake-bite in 1848, with success, and has since employed it in another case with the same result. He simply applied the tincture by means of a camel's hair pencil. (*Boston Med. and S. Journ.*, l., 328.)

Still another topical application of iodine is the inhalation of its vapour in *chronic inflammation of the bronchial tubes.* It has even been recommended in this way as a remedy in *phthisis;* but a moment's consideration will convince a reflecting physician, acquainted with

the real condition of the lungs in this disease, of the utter inadequacy of iodine, or any other known inhalation, to make a serious impression upon it. The most that can be expected is a favourable modification of the attendant laryngitis or bronchitis; and there is probably more danger of injurious irritation than probability of benefit in the case. But in pure *chronic laryngitis or bronchitis*, the inhalation may be tried with the hope of benefit. It may prove useful in *aphonia* also, whether arising from debility or chronic inflammation of the mucous membrane. The preparation generally used for the purpose is the *compound solution of iodine*, to which the reader is referred.

Contraindications to the use of iodine are offered by high febrile excitement, acute inflammation with fever, and gastritis.

4. *Preparations of Iodine.*

Iodine itself, in the solid state, is now seldom if ever prescribed, and never ought to be. Some acquaintance, however, with its physical properties and chemical relations is essential to the physician. For the mode of its preparation, I must be content with referring to the U. S. Dispensatory, as also for the methods of detecting its presence, and the signs of purity of its various preparations.

Iodine is an elementary body. It is a heavy, opaque solid, of a bluish-black colour, with a lustre approaching the metallic, and not unlike plumbago in appearance. It has a peculiar odour, analogous to that of chlorine, and an acrid taste. Though nearly insoluble in water, it is capable of imparting a slight flavour to that liquid; but a watery solution of iodide of potassium dissolves it very freely. It is readily dissolved by alcohol and ether; and all its solutions have, when not feeble, a deep yellowish-brown colour, approaching to black. At ordinary temperatures, it is very slowly volatilized; but, with the application of heat, it readily rises in vapours, of a beautiful purple or violet colour, which has given origin to its name. Its chemical relations are so numerous, and affinities so strong, that it is scarcely possible that it should remain long in the stomach in its pure state, at least when used in medicinal doses.

The probabilities are that, when swallowed, or when brought in any other way into contact with the fluids of the body, it undergoes changes, through the reagency of the alkaline salts which it encounters, by which a portion of it is converted into iodide of potassium

or sodium, and possibly into iodates of the alkalies of these metals respectively. Through the influence of the alkaline iodides thus formed, the iodine itself becomes soluble in the liquids, and thus enabled to exercise its own immediate influence. This results in the coagulation of the albumen present, supposing it to have been deprived of its alkaline matter in the previous changes; so that it would seem impossible for iodine to enter the blood in its uncombined state. For, so long as there is alkaline matter present, it converts the iodine into soluble iodides or iodates; and, should it all have been consumed, and a portion of iodine remain, the albumen coagulates. Hence it follows that, admitted into the circulation, iodine must either undergo the change referred to, or check the circulation by solidifying the albuminous constituent of the blood.

But, as before stated, iodine is highly irritant, and sometimes even corrosive in its uncombined state; and may exercise this property in the stomach, if not carefully guarded. The inference from all this is that, for internal use, when the object is not to produce an irritant impression on the mucous membrane, but to affect the system, and, on the same principle, when the medicine is applied externally with an exclusive view to absorption, the soluble iodides or iodates should be used preferably to the iodine itself; for, whenever the latter is employed, it is admitted into the circulation only in the saline state referred to, while the inconvenience of its local irritant effect is experienced. All its good effects, therefore, are obtained by the direct use of the salts, and the inconvenience avoided.

But there is another reason for not employing uncombined iodine. I have stated that, with the alkaline matter of the blood, it forms both iodides and iodates. Now, the iodates, by the facility with which they part with oxygen to substances having an affinity for it, are liable to be decomposed, thus rendering the iodine free again to exercise its irritant influence. It is better, therefore, to use one of the iodides, by which this inconvenience is avoided, while all the effects desired are obtained. The iodide of potassium is the one almost universally preferred. To M. Mialhe is due the credit of having developed these important practical views. (*Chim. Appliq. à la Physiol.*, Paris, 1856, pp. 221–4.) Should iodine ever be given internally in the solid form, the dose should not exceed one-quarter or half a grain at once.

In treating of the individual preparations of iodine, I shall consider first those in which it exists wholly or in part in the free state, and afterwards its compounds.

a. *Preparations containing free Iodine.*

I. TINCTURE OF IODINE.—TINCTURA IODINII. *U. S.*—TINCTURA IODINEI. *Ed.*

This is prepared by dissolving an ounce of iodine in a pint of alcohol. It is not quite saturated; and it is best, perhaps, as an officinal preparation, that it should not be so; for the least exposure would cause precipitation by the evaporation of the alcohol. Even as it is, it should be kept in a well-stopped bottle. In time, and especially on exposure to sunlight, it undergoes chemical changes, in consequence of reaction between the alcohol and iodine, and should not, therefore, be prepared in large quantities at once.

This preparation is adapted solely to topical use. It cannot be given internally without dilution; and the addition of water to it precipitates the iodine, and thus renders it liable to irritate the stomach. Even for external use, when the object is to affect the system through absorption, it is less suitable than the preparations containing the iodide of potassium. As iodine cannot enter into the blood unchanged, time is required for the requisite chemical reactions; whereas the iodide may be taken up immediately. Whenever, however, the object is simply to produce an impression on the surface of contact, or, by changes in the cuticle, to protect the parts beneath from the action of the air, this is the preparation to be employed.

When applied to the surface, it produces considerable pain and inflammation, followed usually, if the quantity applied has been considerable, by desquamation of the cuticle. The best method of applying it is by means of a camel's-hair pencil. To produce the full effect, it should be used undiluted; and it is often advisable to renew the application daily, or oftener. When used for injection into serous cavities, as in hydrocele, ovarian dropsy, empyema, &c., it should be diluted with an equal bulk, or twice its bulk of water. M. Velpeau uses the latter proportion, M. Bérard the former. M. Jobert injects it, without dilution, into purulent cavities. (*Trousseau and Pidoux*, 4e ed., i. 225.) As an embrocation in scrofulous tumours, and other swellings and indurations, it may be diluted with from four to six parts of camphorated tincture of soap; but other preparations of iodine are preferable for this purpose.

The particular circumstances under which it is used have been already enumerated, or will be so hereafter under rubefacients or protectives.

If given internally, the dose may be from ten to twenty drops, gradually increased to thirty or forty, three times a day. It may be given in sweetened water, or wine, when not contraindicated. A good vehicle is syrup of orange-peel, diluted with water.

II. COMPOUND TINCTURE OF IODINE.—TINCTURA IODINII COMPOSITA. *U. S.*, *Lond.*, *Dub.*

As directed by the U. S. Pharmacopœia, this is made by dissolving half an ounce of iodine and an ounce of iodide of potassium in a pint of alcohol.

This preparation is, at least theoretically, better adapted for internal use than the preceding, upon two grounds; first, that, in consequence of the iodide of potassium it contains, it is not liable to precipitation on the addition of water; and secondly, that, for the same reason, it acts more promptly on the system, through its greater facility of absorption. It is also preferable to the simple tincture for local use, when the intention is that the iodine should be absorbed; and it may, therefore, be employed, more or less diluted with water, in the way of embrocation, or by means of compresses of linen saturated with it. For the more powerful local effect of iodine on the surface, it is less suited than the simple tincture, as it contains much less free iodine.

The dose is from fifteen to thirty drops, which may be increased, if thought desirable, until some evidence of its action is presented. It may be given in sweetened water.

III. COMPOUND SOLUTION OF IODINE.—LIQUOR IODINII COMPOSITUS. *U. S.*—IODINEI LIQUOR COMPOSITUS. *Ed.*

The U. S. officinal solution is made by dissolving six drachms of iodine and an ounce and a half of iodide of potassium in a pint of distilled water. It will be perceived that it differs from the preceding only in its strength, which exceeds that of compound tincture by one-third, and in having water instead of alcohol as the solvent. The iodine is dissolved in the water through the agency of the iodide. The preparation is the stronger solution used by Lugol, and hence is frequently called *Lugol's solution.*

This is a very convenient form for the exhibition of iodine, whenever the object is to give it in a free state, and may be used for all the purposes aimed at through the absorption of the medicine. Its disadvantage is that, by the presence of the free iodine, it cannot be increased to the extent which may sometimes be

deemed desirable, for fear of producing gastric irritation; and, even in moderate doses, it is more liable to irritate the stomach than if it were a solution of iodide of potassium alone. If the remarks made in a preceding page, in reference to the changes which iodine must undergo previously to absorption, are correct, there can be no occasion for the use of free iodine, when the object is to affect the constitution; and the use of this preparation might be limited to cases, in which it is desired to produce a direct excitant or alterative impression on the alimentary mucous membrane.

The dose is from six to twelve drops, to be gradually increased if necessary, given in a wineglassful of sweetened water, and repeated two or three times a day. In the use of this, as of all the other preparations containing free iodine, should irritation be produced when they are given on an empty stomach, this may subsequently be avoided, in most instances, by administering the dose after a meal.

This preparation may be used for inhalation, embrocation, injection, bathing, &c.

For *inhalation* a little of it may be put into an inhaler with warm water, and the vapours inhaled daily, twice a day, or oftener, according to the effects. One or two fluidrachms may be mixed with half a pint of water, and the proportion increased or diminished according to the effect. Should an irritant impression be produced in the air-passages, the quantity should be lessened so as simply to keep within that point; should no sensible impression result, the proportion may be increased until a slight irritation is caused; and then maintained or diminished.

For *embrocation*, it may be used diluted with six, eight, or twelve times its bulk of water.

To produce a strong impression upon limited extents of surface, with the cuticle sound, or for careful application to indolent or fungous ulcers, the solution may be used of its full strength, and should be applied by means of a camel's-hair pencil; but the simple tincture, or a still stronger preparation, is usually employed for these purposes.

For *local application to delicate surfaces*, as, for example, to the eye in scrofulous ophthalmia, to the nostrils in ozæna, or to the external meatus in chronic otirrhœa, from three to twelve minims may be added to a fluidounce of distilled water; and the proportion increased as circumstances may require. The same course may be

pursued in fistulous ulcers, which, however, will often demand a much greater strength for the required impression.

For *pediluvium*, two fluidrachms of it may be added to a gallon of warm water, and the proportion increased if no irritation result.

For *general bathing*, a fluidrachm containing about three grains of iodine may be added to each gallon of water, in a *wooden bathing tub*.

IV. OINTMENT OF IODINE.—UNGUENTUM IODINII. *U. S.*

The U. S. Pharmacopœia directs this to be made by incorporating twenty grains of iodine and four of iodide of potassium with an ounce of lard; the iodine and iodide being first rubbed with six minims of water. The use of the iodide is simply to facilitate the incorporation; and the preparation is strictly an ointment of iodine. It should be prepared as wanted, as it is changed by time.

This is used chiefly for friction over the surface of enlarged glands and other tumefactions, or to the insides of the legs and arms, with a view to the absorption of the iodine. It is apt, when often repeated, to irritate the surface, and cause a pustular eruption. The quantity to be used varies with the extent of the surface of application, from a scruple to one or two drachms.

V. COMPOUND OINTMENT OF IODINE.—UNGUENTUM IODINII COMPOSITUM. *U. S., Lond., Ed., Dub.*

This is made, according to the U. S. Pharmacopœia, by rubbing half a drachm of iodine and a drachm of iodide of potassium, first with a fluidrachm of alcohol, and then with two ounces of lard.

The compound is preferable to the simple ointment, as the iodide of potassium contained in it is probably more easily absorbed than free iodine; and absorption is what is aimed at in the employment of either. It is very often used to aid the internal use of the medicine in bringing the system under its influence. It may be applied in the same quantity and method as the simple ointment. Both may be used as dressings for indolent scrofulous ulcers.

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b. *Preparations in which Iodine is Chemically Combined.*

I. IODIDE OF POTASSIUM.—POTASSII IODIDUM. *U. S., Ed., Lond., Dub.—Hydriodate of Potassa.*

This is made according to different processes. Our officinal code directs that iodine and potassa should be dissolved together in water, the solution evaporated, charcoal incorporated towards the

close of the evaporation, the resulting dry mass heated to dull redness, the saline matter afterwards dissolved out of it by water, and the solution, finally, filtered, evaporated, and set aside to crystallize. The iodine and potassa react on each other, a part of the latter yielding its oxygen to a part of the former to produce iodic acid, which unites with the undecomposed potassa forming iodate of potassa, while the separated potassium and the remaining iodine unite to form iodide of potassium. By the heat subsequently applied, with the aid of the charcoal, the iodate of potassa is deprived of its oxygen, and is converted into iodide of potassium; so that the matter extracted by the water consists exclusively of the latter salt, which is obtained by evaporation.

Properties. Iodide of potassium is in white or translucent crystals, inodorous, of a saline acrid taste, very freely soluble in water cold or hot, somewhat less so in alcohol, decrepitating with heat, and volatilizable at a high temperature without change. When quite pure, it is said to be permanent in the air whether dry or moist; but, as ordinarily found, it is slightly deliquescent in a moist air, and sometimes very much so, in consequence of the presence of carbonate of potassa as an impurity. Its great importance and liability to adulteration render it desirable that every one should be able to recognize it, and judge of its purity. It is known to be an iodide by the production of a blue compound, decolorizable at a boiling heat, when to its solution in water, a cold solution of starch and a few drops of strong nitric acid, or chlorine water, or a mixture of the two are added. That it is a compound of potassium is proved by a copious precipitation of white bitartrate of potassa, when a strong solution of tartaric acid is added in excess to a strong solution of the iodide. The most common adulteration is probably carbonate of potassa. This is detected by producing a milky turbidness with lime-water, and by being left behind when the salt is dissolved by alcohol. Iodate of potassa is often accidentally present, from its incomplete decomposition in the preparation of the salt. It is an injurious impurity, in consequence of the facility with which its acid parts with oxygen, and the iodine is liberated. This change will even gradually take place by time alone: but is much accelerated by various chemical reagents; so that the iodate could scarcely be introduced into the stomach, without undergoing decomposition and evolving iodine. As the iodide is sometimes given largely, it will be readily understood why it should now and then irritate the stomach unexpectedly.

If it contain a considerable proportion of iodate, this is what might be expected. The absence of this salt should always, therefore, be determined before large doses of the iodide are exhibited. It may be detected by adding concentrated acetic acid to the solution of the suspected salt. If the iodate is present, the fact will be shown by the liberation of iodine, which will produce a blue colour on the addition of starch (Mialhe). The iodate also, like the carbonate, is left behind when the salt is dissolved in alcohol. Other occasional impurities are the chlorides of potassium and sodium, and the bromide of potassium; but, for the means of detecting these, I must content myself with referring the reader to the U. S. Dispensatory.

Incompatibles. Iodide of potassium is decomposed, with precipitation, by the soluble compounds of mercury, lead, and silver, and by the bitartrate of potassa, and, with the evolution of hydriodic acid, or iodine, by sulphuric, nitric and muriatic acids, and by chlorine. By prolonged contact, it renders the insoluble compounds of mercury, and even mercury itself soluble.

Effects on the System. These have been already sufficiently described under the general head of iodine. In its local operation, it differs from iodine in being much less irritant; and large quantities may generally be taken into the stomach with impunity. Sometimes, however, it irritates, even in moderate quantities, producing nausea, colicky pains, and looseness of the bowels. This is ascribed by M. Mialhe to the presence of iodate of potassa. It may sometimes be owing to individual peculiarity. If freely given, it may result from its having been administered in too concentrated a solution.

Therapeutic Application. This is the preparation now most commonly used, when the effects of iodine on the system are desired. It is probably capable of producing whatever good effects can be obtained from any other preparation of that substance, so far as the iodine itself is concerned. I have myself long been in the habit of using it almost exclusively. The diseases, and special conditions of disease in which it may be expected to do good, have already been sufficiently detailed.

The dose is for an adult from five to twenty grains three times a day. I have almost invariably found five grains to be well borne by the stomach; and have generally been able to procure all the expected therapeutic effects from this dose, which I therefore seldom exceed. Sometimes, however, a case which has advanced

favourably under this dose for some time, will cease to make progress; and will again improve under an increase of the dose. Under these circumstances, it is occasionally useful to add to the iodide a little of the compound solution or tincture of iodine, instead of augmenting the dose of the salt itself. In cases of great susceptibility of the system, or unusual delicacy of stomach, the dose may be reduced. It should be given in a wineglassful of water, sweetened water, or some demulcent liquid; and, if increased, the proportion of liquid should be increased accordingly. To cover the taste, and render it more acceptable to the stomach, it may be given in carbonic acid water, sweetened with syrup of lemon or ginger. The quantities which are said to have sometimes been taken with entire impunity are enormous, amounting even to half an ounce or six drachms in twenty-four hours.

Iodide of potassium may also be used externally, in the form of lotion, cataplasm, ointment, or bath, and in this way is capable of producing the effects of iodine on the system, and probably not less decidedly than the iodine itself, employed in the same way. It has here also the advantage, over uncombined iodine, in reference to the constitutional impression, that it is less irritant, and may, therefore, be used largely with less unpleasant local effects.

The Ointment of Iodide of Potassium (UNGUENTUM POTASSII IODIDI, *U.S.*, *Lond.*, *Dub.*) is prepared by dissolving a drachm of iodide of potassium in a fluidrachm of boiling water, and mixing the solution with an ounce of lard.

In this preparation, the salt has the advantage of being in solution, so that it probably acts better than if the powder merely were mixed with the lard. It is preferable to the ointments of iodine from this circumstance, if nothing else, that it does not discolour the skin.

II. OINTMENT OF IODIDE OF SULPHUR.—UNGUENTUM SULPHURIS IODIDI. *U. S.*, *Lond.*

This ointment is made by simply incorporating iodide of sulphur with lard, in the proportion of half a drachm of the former to an ounce of the latter. The iodide of sulphur is procured by fusing a mixture of sulphur and iodine.

It is one of the most effectual alterative applications in old and obstinate skin diseases; and is peculiarly adapted to psoriasis, lepra, pityriasis, and porrigo, and to the very advanced stage of impetigo and eczema.

III. IODIDE OF STARCH.—AMYLI IODIDUM.

This, though not an officinal preparation, is based upon sound principles, and has been found practically useful. In all probability it is the first compound formed, when iodine is taken with, or immediately after, amylaceous food. It is well known that there is a strong disposition, between starch and free iodine, to unite and form a blue compound, insoluble in cold water. This compound is very bland, and almost free from the irritating properties of iodine; and, when taken into the stomach, readily gives up the iodine to the chemical influences there exerted upon it, by which it becomes soluble, and enters the circulation without difficulty. This is proved by the discovery of iodine in the urine, within a short period after it has been thus administered.

It was first proposed as a medicine by Dr. A. Buchanan, of Glasgow, who prepares it by rubbing twenty-four grains of iodine with a little water, and then with an ounce of fine starch gradually added, and continuing the process until the powder assumes a uniform blue colour. It is then dried by a moderate heat, and kept in well-stopped bottles. He gives a heaped teaspoonful, mixed with water-gruel, three times a day, and increase the dose, if deemed desirable, to a tablespoonful. He has even given an ounce without unpleasant effect; as the compound produces little or no irritation of stomach or bowels. It is peculiarly indicated, whenever the object is to introduce as much iodine as possible into the system, without risk of injury to the stomach.

IV. CHLORINE.

CHLORINIUM. *Dub.*—CHLORINEUM. *Ed.*

Chlorine, in its various compounds, seems to have a certain controlling influence in their operation upon the system, giving them, in some degree, a similarity of character in this respect, though much modified by the peculiar properties of the base, or of other associated bodies.

A certain amount of the chlorides in the system, and especially of the chloride of sodium, is absolutely essential to health, and probably to life. They have been supposed to be useful by affording muriatic acid to the process of digestion; but this is assuredly not

the whole, nor probably the most important office they perform in the animal economy. What that office precisely is, we do not know; but it has been observed that a deficiency of common salt conduces to a low state of the vital powers, and a depraved condition of the blood, disposing to a kind of malignancy in disease, as exhibited in the low typhous state of fever and inflammations, gangrenous affections, passive hemorrhages, &c.

It is in such affections, and in those of a strumous or scrofulous nature, that the compounds of chlorine have been found beneficial, or at least have been supposed to be so. To correct the state of the blood and the vital forces in that peculiar depravation above mentioned; to act as deobstruents or resolvents in strumous swellings, and other indurations, consolidations, or tumefactions; and to obviate generally the effects of the scrofulous diathesis, are the common purposes to which they have been applied, and to which experience would seem to have appropriated them, altogether irrespective of their resemblance in chemical character, and, to a certain extent, even before this resemblance was known. This will be rendered obvious in the remarks on the several preparations which follow. It would seem scarcely possible that there should have been such a practical appropriation of these varied bodies, based upon experience, without some real ground in truth; and a rational explanation of the fact is offered by the common chemical tie between them.

Chlorine itself, in its uncombined state, probably never enters the blood. Its chemical affinities are such that it would, in all probability, saturate itself very speedily, upon contact with any of the fluids of the body, either with hydrogen or one of the alkaline or earthy metals, forming muriatic acid or chlorides, and possibly chlorates; and whatever constitutional impression it is capable of producing, independent of its topical action on the surface of application, must be ascribed to these or other combinations.

As the several medicinal substances containing chlorine have, for the most part, peculiarities of operation independent of what they all have in common, it will be best to consider them separately. Some of them, as muriatic acid, nitromuriatic acid, chloride of iron, &c., have been treated of under other heads; but, if the reader will refer to what has been stated under each of these, he will note some reference to a peculiar alterative or supposed alterative power possessed by them, as by the muriatic acid in malignant fevers, the

nitromuriatic in chronic hepatitis and certain deranged states of the blood, and the tincture of chloride of iron in erysipelas. I shall notice particularly here only those which have not found a place in other classes.

I. GASEOUS CHLORINE.

Effects on the System. This gas is extremely irritant, inflaming the skin if allowed to remain in contact with it, and, even when diluted with air or watery vapour, at a somewhat elevated temperature, giving rise in a few minutes to prickling sensations, followed sometimes by a papular or vesicular eruption. When undiluted, it is quite irrespirable, in consequence of the intense irritation, and spasmodic closure of the glottis, which it provokes. I once knew a violent attack of spasmodic croup to be brought on, in a child, by a bottle of chlorine held to his nostrils during inspiration. When mixed with a certain quantity of atmospheric air, it becomes respirable: but, unless much diluted, produces inflammation of the bronchia, with violent cough, and a feeling of constriction of the chest, as if from spasm of the tubes, usually followed by copious expectoration. Even when much diluted, it is apt to produce irritation of the throat and severe coughing. To a certain extent, the lungs may become accustomed to its presence in the air, so as to feel its irritant influence much less than at first. Sufficiently diluted, it may be inhaled without inconvenience, producing only a feeling of warmth, and an increase of the mucous secretion, and no otherwise disagreeable than by its smell.

The effects of the gas upon the system at large have not been well determined. According to Mr. William Wallace, when applied by means of a vapour bath to the surface of the body, it tranquillizes while it invigorates the nervous system, occasions soreness of the mouth and throat, increases the flow of saliva, and has an alterative and excitant influence on the liver.

But the most important property of chlorine, in its medical relations, is that of destroying or neutralizing fetid exhalations, and correcting offensive smells, proceeding from animal putrefaction. This effect it owes to its affinity for hydrogen, by which it either directly decomposes the fetid matters, or, by the liberation of oxygen from the accompanying moisture, enables that agent in a nascent state to react on those products, and thus as it were burns them.

Medical Uses. Chlorine has been used, in the gaseous state, for four purposes; 1. to affect the system through its application to the surface, 2. to produce curative impressions on the lungs by inhalation, 3. as an antidote to hydrocyanic acid, and other poisonous gases, and 4. as a disinfectant.

1. Mixed with atmospheric air or watery vapour, at the temperature of from 120° to 150° F., and applied by means of a *vapour bath*, Mr. Wallace found it very beneficial in *chronic hepatitis*, acting both as a revulsive to the surface, and as an alterative upon the liver; and the practice has been imitated successfully by more than one physician in Germany. The patient may remain in the bath twenty or thirty minutes.

2. The *inhalation of chlorine* has been recommended in *phthisis* and *chronic bronchitis*. As to its beneficial influence in the former affection, I have no faith whatever; but, on the contrary, should, on the whole, have more fear of evil from it than hope of good; nor has experience pronounced in its favour. But as a useful remedy in chronic inflammation of the air-passages, I can speak confidently of its good effects. More than thirty years ago, being subject to obstinate catarrhal attacks, and delivering annually a course of lectures on chemistry, I noticed that, after lecturing on the subject of chlorine, and being consequently exposed for several days in my laboratory to the effects of the gas, I was, in several instances, cured or much relieved of the bronchial affection. From this fact I inferred the efficiency of chlorine inhalations in chronic bronchitis, and have ever since taught this use of the remedy to my pupils. Others have found it not less beneficial. In cases of *foul breath with purulent expectoration*, whether gangrene of the lungs be or be not supposed to exist, the inhalation of chlorine is indicated, both as a corrigent of offensive odours, and an alterative local stimulant. The most convenient and efficient method of applying it, is to cause the air of the apartment, in which the patient may be situated, to be so far impregnated with the gas as to produce a slight impression when inhaled, but not sufficient to excite continued coughing. In this way its influence is steadily maintained, instead of intermittingly, as it must be when an inhaler is used.

3. Perhaps no *chemical antidote* is so efficient as chlorine, in *poisoning induced by the inhalation of hydrocyanic acid, sulphuretted hydrogen*, or *hydrosulphate of ammonia*. By abstracting the hydrogen of these gases, it instantly decomposes them, and renders them comparatively harmless. The misfortune is, that, in the case of hydro-

cyanic acid, the effects are generally so rapid that no time is allowed for the application of the antidote. The proper method of using it is to extricate some chlorine in the vicinity of the patient, and, if he still breathes, allow him to inhale it, mixed with the atmospheric air; if not, to throw into the lungs, by the ordinary process of artificial respiration, the atmospheric air thus impregnated. Care must be taken that the gas is not too copiously extricated; and the operator's own sensations will be the best criterion of the due degree of admixture.

4. The use of chlorine *to correct fetid exhalations* is a most admirable result of modern science, not only promoting the comfort both of the sick and well, but operating powerfully in the prevention of disease. It should be employed in all cases of foul exhalation, in the absence of other equally effectual and less disagreeable methods, whether in sickness or health. It was a very reasonable supposition, from its great efficiency in correcting offensive odours, and purifying the air, that it might prove efficient also in the destruction of contagious effluvia, and perhaps even of those aerial influences through which epidemic diseases spread. But, in relation to yellow fever and cholera at least, it has proved utterly ineffective in preventing their progress. Though applied in every possible method, it failed to check the yellow fever in Gibraltar in 1822; and in Paris, Moscow, and other places, it was found to have quite as little restraining influence over cholera. It has not proved more efficacious in preventing hospital erysipelas, though the air of the wards might be kept by it perfectly free from offensive smell. The present state of belief on this subject is that, so far as putrid emanations are concerned, it is quite adequate to prevent all their ill effects on the health; but that it is powerless to check epidemic diseases, and of very doubtful efficacy in decomposing proper contagious effluvia.

The most convenient method of disengaging chlorine is to add sulphuric acid, diluted with a little water, very gradually, either to chloride of lime, or to a mixture of equal parts of common salt and black oxide of manganese, placed in a shallow vessel. For inhalation, Dr. Christison recommends one part of chloride of lime to be dissolved in forty parts of water, the solution to be kept at 100° Fahr., and a drop or two of sulphuric acid to be added from time to time, as the gas is wanted; or chlorine water may be employed, as mentioned below. The application may be made from four to six times a day.

II. SOLUTION OF CHLORINE.—CHLORINII LIQUOR. *Dub.* —CHLORINEI AQUA. *Ed.*—*Chlorine Water.*

Preparation. This is prepared either by passing chlorine gas through water, as directed by the Dublin College, or by mixing common salt, red oxide of lead, and water in a bottle, and then adding sulphuric acid; all the ingredients being used in fixed proportions. The latter is the Edinburgh process, and accomplishes the object without the necessity for disengaging the gas. The resulting liquid is a solution of chlorine, containing a little sulphate of soda; the sulphate of lead, which is also formed, being deposited.

Properties. Chlorine water has a pale yellowish-green colour, the peculiar odour of chlorine, and an acrid, somewhat astringent taste. It quickly bleaches vegetable colours, destroys the fetor of putrefaction, and dissolves gold leaf. It undergoes chemical change by time, and especially on exposure to light; the chlorine uniting with the hydrogen of the water to form muriatic acid, and oxygen escaping. It should not, therefore, be kept long; and the Edinburgh formula is convenient as enabling it to be readily prepared on a small scale, when wanted for use. Prepared according to the Dublin formula, it should be nearly or quite saturated, and contain about double its bulk of the gas.

Effects on the System. When of the full officinal strength, chlorine water is powerfully irritant, producing inflammation of the skin, and acting as a corrosive poison when swallowed. Sufficiently diluted, it may be used locally, or taken internally, without inconvenience. Upon the stomach it acts as a tonic, and, on the system at large, is supposed to have an alterative effect, obviating the tendencies to depravation of the blood, and extending a peculiar influence to the liver. It has all the disinfectant properties of chlorine, and is thought to be antiseptic; that is, not only to correct fetor in gangrenous parts, but also to have some positive power of checking the progress of mortification. Its continued internal use is said to have caused salivation.

Medical Uses. Chlorine water has been used internally in febrile diseases of a malignant character, or disposed to that condition, as *typhus*, *smallpox*, *scarlatina*, and *erysipelas*, in their lowest forms; also as an alterative in *chronic hepatic* and *syphilitic affections*. The dose is from half a fluidrachm to two fluidrachms, according to the strength, in three or four fluidounces of water. If the preparation be saturated, more than thirty minims, according to Orfila, may cause irritation of the stomach, with nausea and vomiting.

It has been used for the *inhalation of chlorine;* from ten to thirty drops being added to six or eight fluidounces of water in the inhaler.

But its *topical* uses are most important. It is asserted to have been employed, with great success, as a local application to the bites of mad dogs, with the view of preventing hydrophobia. Several writers have recorded their favourable experience on this point; and Semmola states that he has successfully treated nineteen cases of individuals bitten by mad dogs, by washing the wounds with a dilute solution of chlorine, dressing them twice a day with compresses saturated with the same liquid, and administering, for forty or fifty days, three times daily, from two drachms to an ounce of the solution, sufficiently diluted with sweetened water. M. Coster tried the remedy on dogs. Two of them were inoculated with the saliva of a mad dog, and, besides, were bitten by the rabid animal. The wounds of one were washed sedulously with a solution of chloride of soda in half its volume of water, which was also injected into the wounds; the other animal was treated similarly with pure water; the former was not attacked by the disease; the latter died of hydrophobia, thirty-seven days after the infliction of the wounds. (Trousseau et Pidoux, *Traité*, &c., 4e ed., i. 343.) Nevertheless, this measure should never be relied on, to the exclusion of the knife. Under circumstances which may be considered as forbidding the use of the knife, as where parts are wounded which cannot be removed without involving a removal of the limb, it may be proper to have recourse to it, though certainly an apocryphal measure.

Diluted chlorine water has also been used as a wash in *scabies* and *porrigo*, as an antiseptic and stimulant application to *cancerous* and *sloughing ulcers*, as a gargle in *malignant sore-throat* whether an original affection, or attendant on scarlet fever, and as a rubefacient in chronic *diseases of the liver.*

III. CHLORINATED LIME.—CALX CHLORINATA. *U. S., Lond., Ed., Dub.—Chloride of Lime.—Hypochlorite of Lime.*

Preparation and Properties. This is made by exposing hydrated or slaked lime to the action of chlorine, continued until the lime will absorb no more. It is a whitish powder, of an odour resembling that of chlorine, yet somewhat different, and a strong, bitter, acrid, and astringent taste. When the lime is accurately saturated, the compound is said to be wholly soluble in water; but it is seldom if ever met with in this state; always probably containing more or less carbonate of lime, which, with a portion of the hydrate of lime,

is left behind when the salt is dissolved. On exposure to the air, it slowly absorbs carbonic acid, giving out its characteristic odour. The acids generally cause the evolution of chlorine, by combining with the lime. The alkaline carbonates throw down carbonate of lime from its solution. It has the property of evolving oxygen, or of causing its evolution by abstracting hydrogen from water, thus operating, like chlorine, as a decolorizing and disinfecting agent; the oxygen, in its nascent state, combining with and destroying the colouring and putrescent principles.

Nature. Different views are entertained of its chemical nature. The simplest is that which considers it merely as a compound of lime and chlorine, held together by feeble affinities. According to another, and the most common view, it is a mixture of hypochlorite of lime and chloride of calcium; the hypochlorous acid being formed by the combination of a part of the chlorine with the oxygen of a portion of the lime, and then combining with the undecomposed part of the lime, while the liberated calcium combines with the remainder of the chlorine to form the chloride. If this were the correct view, one would suppose that the salt should be deliquescent; as chloride of calcium, supposed to be contained in it, has this property in a high degree. A third opinion considers it an oxychloride of calcium; the metallic base uniting with an equivalent of chlorine in addition to the equivalent of oxygen already combined with it. In this uncertainty as to its precise nature, the officinal authorities have done wisely in adopting a name which expresses simply what happens in its preparation.

Effects on the System. These are compounded of the effects of lime, chlorine, and chloride of calcium. Locally the preparation is in a greater or less degree irritant, corrosive, astringent, disinfectant, and antiseptic; internally it produces the antacid effects of lime, the constitutional impression of chlorine and the chlorides, and the local irritant effect of all its constituents on the alimentary mucous membrane.

Medical Uses. Chlorinated lime has been given in affections, similar to those to which the preparations of chlorine have been thought adapted, especially in typhoid fevers and scrofulous complaints; and it may be employed, with hope of benefit, in cases of offensive personal exhalations, which may be supposed to have their origin in putrefactive changes going on in the alimentary canal; as, for example, in malignant forms of dysentery, in which it may be administered both by the mouth and the rectum. But it is at

present little used internally. Topically, however, it is much employed for various purposes.

Notice has already been taken of its use for the extrication of chlorine, for purposes of inhalation and disinfection. The spontaneous evolution of chlorine, which takes place from it under the influence of the carbonic acid of the atmosphere, renders it useful for the latter purpose, even without addition; the moist powder being placed, in shallow vessels, in situations requiring purification, or a solution of it sprinkled in apartments, and over objects, rendered offensive by putrid exhalations. Its addition to the close-stool, in cases of offensive discharges, and especially those of bad attacks of dysentery, will tend to obviate ill effects from this source. Though quite ineffective in destroying the cause of epidemic diseases, as yellow fever and cholera, there is some reason to think that it is capable of neutralizing or decomposing certain contagious matters. Its supposed effect in preventing hydrophobia has been mentioned. It is said to have a similar effect on the contagion of syphilis and the plague.

Used as a gargle in the *gangrenous*, *ulcerated*, or *pseudo-membranous angina of scarlatina*, and in similar affections of the mouth and fauces from other sources, as from *mercury*, *syphilis*, *scurvy*, &c., it is useful not only by correcting the fetor, but also by obviating in some degree the gangrenous tendency, and stimulating the diseased surface into a healthy state. In cases of *gangræna oris*, the powder itself has been sprinkled on the diseased surface with great asserted advantage. In offensive discharges from the nostrils and ears, whether acute or chronic, the solution may also be injected with good effect. It is thought to have proved serviceable, as a wash for the eyes, in scrofulous ophthalmia.

In *sloughing ulcers*, *sphacelus from burns* or other cause, *gangrenous abscesses*, and *offensive suppurating surfaces* of whatever kind, the solution of chloride of lime may be applied upon suitable dressings; or injected, as the case may be. It is much used in this way in *cancerous sores*, and in *cancer of the womb*, as well as other cases of offensive discharges from the vagina. It may be used also, simply as an alterative local stimulant, in all *flabby* and *indolent ulcers*, especially those of *scrofulous origin*, and those succeeding *frost-bite*.

In various cutaneous eruptions, the solution is also very serviceable, especially those of parasitic origin, whether animalcular or fungous; as *scabies* of the former kind, and *porrigo* and *trichosis* of the latter. Dr. Christison, who ascribes the first use of the solution

in the itch to M. Derheims, states that he has never had occasion to use any other remedy in that affection since he became acquainted with its powers. "A solution," he says in his Dispensatory, "containing between a fortieth and a sixtieth of chloride, applied five or six times a day, or continuously with wet cloths, allays the intense itching in twenty-four hours, and generally accomplishes a cure in eight days." He also recommends it in all eruptions attended with itching.

Administration. For internal use, the dose is from three to six grains, which, in acute cases, may be given every two hours or oftener, in chronic cases three times a day; but, should it irritate the stomach in that dose, as it is said sometimes to do, the quantity must be diminished. The dose should be given in a wineglassful of water, which may be sweetened and aromatized if desired.

For *lotions*, *mouth-washes*, and *gargles*, from one to four drachms of the chloride may be dissolved in a pint of water; and, when the preparation is to be applied to the unbroken skin, in cutaneous eruptions, the solution may sometimes be made of double this strength. When used as a gargle, this solution may be sweetened with honey, and flavoured with aromatics.

An *ointment* for application to ulcers, or by friction to scrofulous swellings, may be made by incorporating from a scruple to a drachm of the chloride with an ounce of lard or butter.

As an *enema*, in offensive discharges, from ten to twenty grains may be given, either added to injections for other purposes, or dissolved in half a pint of water.

IV. SOLUTION OF CHLORINATED SODA.—LIQUOR SODÆ CHLORINATÆ. *U. S., Lond., Dub.—Labarraque's Disinfecting Liquid.*

According to the U. S. Pharmacopœia, this is made by mixing solutions, of definite strength, of carbonate of soda and chlorinated lime. An interchange of principles takes place, by which the lime takes the carbonic acid of the carbonate of soda, and is precipitated as carbonate of lime; the soda remaining in solution, combined as the lime had previously been, together with a portion of the carbonate of soda undecomposed. The views of the precise chemical nature of the solution differ, as in the case of chlorinated lime; the predominant opinion, though very questionable, being, that it contains hypochlorite of soda, chloride of sodium, and the excess of carbonate of soda just referred to.

This solution, or one of equivalent character, was first prepared

by M. Labarraque, by whom its use as a disinfecting agent was strongly urged and with no little success.

The solution is colourless, with a smell recalling that of chlorine, an acrid astringent taste, and an alkaline reaction.

It has similar properties, and may be employed for the same purposes with chlorinated lime. In addition, it has been used internally in *chronic cutaneous eruptions*, *secondary syphilis*, and *hepatic disorder;* in some of which affections, the advantages obtained for it may have depended on the excess of the carbonated alkali contained in it. For local purposes, and as a disinfecting agent, its uses are so precisely those of chlorinated lime, that it is quite unnecessary to repeat them.

The *dose* for internal use is from twenty to thirty drops, in a wineglassful of water. The solution is poisonous in over-doses.

For a *lotion*, a fluidounce may be added to a pint of water; the strength being increased or diminished, according to circumstances. As a *gargle*, it may be used of half the strength, or somewhat more.

Cataplasms, for application to sloughing ulcers, may be made by mixing equal parts of the solution and of water with flaxseed meal.

V. SOLUTION OF CHLORIDE OF CALCIUM.—LIQUOR CALCII CHLORIDI. *U. S., Dub.*—CALCIS MURIATIS SOLUTIO. *Ed.—Solution of Muriate of Lime.*

Preparation. This is prepared by treating marble with muriatic acid, evaporating the resulting solution to dryness, disolving the residue in its weight and a half of water, and filtering. Marble is a compound of carbonic acid and oxide of calcium, muriatic acid of chlorine and hydrogen. The chlorine of the latter unites with the calcium of the former to produce chloride of calcium, which remains in solution; the carbonic acid of the marble escaping, and the liberated oxygen and hydrogen combining to form water. The subsequent steps of the process are merely intended to furnish a pure solution of the chloride, of definite strength.

Properties and Incompatibilities. This solution is inodorous, has a bitterish, acrid taste, and yields precipitates with sulphuric acid, the soluble sulphates, phosphates, tartrates, and carbonates, the soluble salts of silver and lead, the soluble protosalts of mercury, and the pure alkalies.

Effects on the System. Chloride of calcium is a local irritant, capable, when taken too largely into the stomach, of producing nausea, vomiting, purging, pains in the abdomen, and precordial

tenderness, indicating the existence of inflammation of the alimentary mucous membrane. It is thought also, in over-doses, to act on the nervous system, causing giddiness, trembling, small pulse, cold sweats, convulsions, paralysis, coma, and death. In medicinal doses, it increases the secretions, and exercises an alterative influence, exhibited by the softening and gradual dispersion of chronic swellings and indurations.

Therapeutic Application. Before the discovery of iodine, and its use as a remedy in scrofula, chloride of lime was among the most popular remedies in that complaint. It is still occasionally used in the treatment of scrofulous swellings of the external and internal absorbent glands; and, from the united testimony of many practitioners, must be admitted to possess useful powers in these affections. It is especially recommended in tabes mesenterica. The dose is from thirty minims to a fluidrachm, to be repeated two or three times a day, and gradually increased until it evince that it is acting, either by nausea or some other disturbance of the system. The dose has been increased to three fluidrachms or more. The solution has also been used externally in the form of a bath.

VI. SOLUTION OF CHLORIDE OF BARIUM. — LIQUOR BARII CHLORIDI. *U.S., Dub.* — SOLUTIO BARYTÆ MURIATIS. *Ed.* — *Solution of Muriate of Baryta.*

This is made from carbonate of baryta in the same method as the preceding preparation from the carbonate of lime.

The solution is inodorous, has a disagreeable bitter taste, and is precipitated by the alkalies, sulphuric acid, the soluble sulphates, carbonates, and phosphates, and the soluble salts of silver and lead.

In over-doses, it is an energetic poison, producing inflammation of the stomach and bowels, and symptoms indicating great disturbance of the nervous system.

In medicinal doses, its effects are closely analogous to those of the chloride of calcium, and it is supposed to have the same remedial powers in scrofulous diseases, for which it was formerly considerably used; though the apprehension of its poisonous effects limited its employment. It is at present very little used. The commencing dose of the solution is from five to ten minims, to be gradually and cautiously increased until nausea, giddiness, or other unpleasant symptoms occur, when it must be again diminished.

In cases of *poisoning*, whether from this chloride or that of lime, the proper antidotes are the alkaline sulphates, which should be

given with large quantities of water; and, if necessary in order to evacuate the stomach, recourse must be had to emetics, or the stomach pump. The symptoms must afterwards be counteracted by opiates, and other remedies which may seem at the time to be applicable.

VII. CHLORIDE OF SODIUM.—SODII CHLORIDUM. *U. S., Lond., Dub.*—SODÆ MURIAS. *Ed.*—*Common Salt.*—*Muriate of Soda.*

Common salt is too well known to require description. I proceed, therefore, immediately to treat of its effects and remedial uses.

Effects on the System. Common salt is essential to health. The irresistible and almost universal craving for it, both by man and the higher animals, is strong evidence that it has some important purpose or purposes in the animal economy; and this is confirmed by its invariable presence in the blood. But, while thus essential to the higher orders of animal existence, it seems to be noxious to some of the lower, and is even poisonous to the leech. What are its special uses is not satisfactorily known. To supply muriatic acid to the digestive process, and soda to the blood, are conjecturally ascribed to it as characteristic offices; but the probability is, that there are other important purposes, connected with the formation and preservation of the blood, which it is intended to fulfil, independently of chemical decomposition. The want of it impairs the general health; and, as there is some reason to believe, disposes to a condition of the blood, analogous to that which characterizes low fevers, and favouring the occurrence of gangrene, and of passive hemorrhages. Dr. Probart, of England, relates the case of a patient affected with gangrene of the lungs, who had abstained from the use of salt for five years. (*Transact. of Prov. Med. and Surg. Assoc.*, xvii., 351.) A belief, too, has long prevailed, that the want of salt in the food disposes to the development and propagation of worms in the bowels. But few opportunities are offered us for judging of the effects of an entire absence of common salt; for, even though it were not used as a condiment, or even in the preparation of food, yet it is so widely diffused in nature, that it is scarcely possible to eat and drink without receiving a portion of it into the system.

It has been thought that an excessive use of it gave rise to serious disorders of health, and among others to scurvy; as this disease is apt to prevail among seamen, who are often for a long time confined to the use of salted meats; but experience has shown that it is not

the salt meat, but the want of fresh vegetable food, that causes the disease; for, with a sufficient supply of the latter, salted food may be eaten to any extent without causing scurvy. Dr. Garrod ascertained that one of the effects of common salt on meat is to expel the salts of potassa, which he found less in proportion in them than in fresh meat; and he has rendered it probable, that the want of the potassa salts in scorbutic blood is one of the circumstances which favour the production of that disease.

At present, it is believed that an excess in the use of common salt disposes rather to an elevated state of the vital processes, to increased fulness of the system, and a plethoric state of the circulation, than to the opposite condition of health.

In moderate excess, salt promotes the appetite and invigorates digestion, and seems to operate as a tonic. More largely taken, it irritates the stomach, and, in very large doses, operates as an emetic, and sometimes as a cathartic, causing at the same time excessive thirst. It is even capable of acting as a poison in enormous quantities. Dr. Christison mentions the case of a man who took a pound of salt, and died in consequence, with symptoms of gastro-enteric inflammation.

Therapeutic Application. Common salt is used remedially for two purposes prominently; for producing irritation locally, and to operate as an alterative tonic to the system at large; and the two purposes are often jointly fulfilled.

In commencing convalescence from acute diseases of some duration, in which the system has received but a scanty supply of salt, I have found nothing more grateful to patients generally than a little salt ham, or salt dried beef, broiled in thin slices, and eaten with bread and a cup of black tea. It is often the first thing that the appetite and the stomach will receive, in the way of food; and it has seemed to me to act favourably, by improving the appetite and invigorating digestion.

In *scrofulous affections*, which are characterized by a deficiency of vital force, salt operates beneficially in various ways; and, in the treatment of these cases, the inquiry should always be made, whether the patient uses sufficient salt in his food, and, if not, care should be taken to correct the deficiency. The sea air, loaded as it is with salt, is noted for its favourable influence, especially in connexion with sea bathing, in most scrofulous affections; we might, indeed, say in all, with the exception of phthisis, in which, from its irritant effect on the lungs, it sometimes acts injuriously. Few re-

medies are more efficient in the *scrofula of children*, whether affecting the glands, the joints, or the spine, than sea air and sea bathing. When the latter is not attainable, it may be imitated by the use of the salt bath, which often does good in the complaint. The bath may be cold, warm, or hot, according to the special indications. If reaction takes place readily, the first may be employed; if there is great debility, the last; in intermediate states, the second. Another mode in which salt is used in scrofula is by topical application to the tumours and ulcers. A poultice made with strong brine proves useful sometimes in dispersing obstinate glandular swellings. It not unfrequently produces irritation of the skin, and even a pustular eruption; but these effects probably contribute to the result.

In *gangrenous conditions of disease*, as suggested by Dr. Probart, attention should be directed to the previous habits of the patient, in relation to the use of salt; and the employment of it, without any special grounds of prescription in the previous want of it, might possibly be useful in these affections. Dr. Probart thought he derived advantage from it in *gangrene of the lungs*.

In *affections of the liver*, it is thought to have proved serviceable as a local application; and, considering how useful many of the natural mineral waters, which usually contain common salt, have proved in hepatic disease, it is not going too far, to claim a portion at least of the advantage produced, for the alterative influence of the salt over the liver.

Cases in which there has been a great loss of saline matter from the blood offer an indication for the use of salt. This indication is prominently presented in *epidemic cholera*, in which salt has been employed in various ways, with apparent advantage. Many practitioners commence the treatment of this disease with an emetic dose of common salt, which they give also by enema. Though no advocate for this mode of using the medicine in that disease, I believe that it may be usefully employed, in many instances, especially after the vomiting has been arrested, in small doses, frequently repeated, in connexion with the bicarbonate of soda; and I can understand, also, that a strong impression made by it on the mucous membrane, in the first stage, may prove useful; but there seems no ground for pushing it so far as to produce emesis, or to aim at that result. In the collapse, or approaching collapse, it may be used as a bath; and, with the carbonate of soda, dissolved in a large quantity of water, may be injected into the veins, in positive cases of collapse, otherwise desperate. Wonderful revival often

takes place after the injection; though, unfortunately, the fatal symptoms generally return, and the remedy fails of ultimate good. Still some cases appear to have been rescued by it.

Common salt is among the numerous remedies which have been found to cure *intermittent fever*, and has been offered as a succedaneum for quinia, which, however, it is not likely to supersede.

As a local irritant, there is one highly valuable use of common salt, in which it shows extraordinary powers. At the commencement of *hæmoptysis*, the case must be very severe, indeed, which will not yield temporarily to from one to four drachms of salt, taken dry into the mouth, and swallowed as the patient can best effect it. I presume that it acts by the powerful impression it makes on a large surface of mucous membrane in the mouth, throat, and œsophagus, thereby calling off vascular excitement from the seat of the hemorrhage, in another portion of the same membrane.

There are not many remedies more efficacious than a *strong hot salt bath* in obstinate cases of *diarrhœa*, especially when associated with deranged hepatic secretion. In one desperate case of the kind, in which the patient was reduced to the lowest stage of emaciation and debility, with copious dark stools, and violent griping pains, and in which the previous treatment had not appeared to make any impression, amendment began to take place soon after the commencement of this remedy used twice daily, and continued on to perfect recovery under it. The salt probably acted at once revulsively, and as an hepatic alterative.

As a local irritant, common salt is frequently used in *purgative enemata*.

With large quantities of water, it has also sometimes been given *as a cathartic*.

I have already spoken of its use as an emetic in cholera. *Connected with mustard*, it might be used in some cases of *gastric collapse*, in *pernicious fever*.

As an *anthelmintic*, it has been used both internally and by enema. In the latter method, it is one of the most efficacious remedies in ascarides; and, should a leech be swallowed, or find its way into the rectum, common salt would be the proper remedy, being administered so as to come in contact with the worm.

Administration. As an alterative, from two grains to a drachm may be given for a dose, as an emetic one or two ounces, and as a purgative from half an ounce to an ounce in half a pint of water. From half an ounce to two ounces may be used for an enema with

a pint of water. In the preparation of the *salt bath*, four ounces may be used for every gallon of water; and the proportion may be doubled or tripled, if a very strong impression on the surface is desired.

VIII. MURIATE OF AMMONIA.—AMMONIÆ MURIAS. *U. S., Ed., Dub.*—AMMONIÆ HYDROCHLORAS. *Lond.*—*Sal Ammoniac.*—*Chloride of Ammonium.*

Sal ammoniac is procured from several sources, but is at present prepared chiefly, on a large scale, from the impure ammonia obtained in the manufacture of coal gas, and in the destructive distillation of bones.

Sensible and Chemical Properties. It is either in white, translucent, concavo-convex cakes, or fragments of such cakes, of a tough fibrous structure, inodorous, of a saline and pungent, or acrid taste, very soluble in water cold or hot, producing cold while dissolving, and soluble also in alcohol, though but slightly so when that liquid is concentrated. The salt deliquesces somewhat in a moist air. It is chemically characterized by being completely volatilized by heat, by yielding the odour of ammonia when rubbed with lime, and by affording, on the addition of nitrate of silver to its solution, a white precipitate of chloride of silver, which darkens on exposure, and is insoluble in nitric acid cold or hot, but is readily dissolved by solution of ammonia. It renders corrosive sublimate more soluble in water, and, by reaction with calomel, produces a solution which may act violently as a corrosive poison.

Incompatibles. These are the alkalies and alkaline earths, the strong acids, and the soluble salts of lead and of silver.

Effects on the System. Muriate of ammonia is a local irritant, and, when absorbed, acts as an alterative, increasing secretion, and stimulating generally the cell-action, while it exercises little if any influence on the heart.

In its local effects, it moderately irritates, and, very freely applied, may inflame the skin, though much less energetic in these respects than the carbonate. Internally taken, if swallowed in powder, it produces a feeling of coolness in the stomach, but, in solution, causes the contrary sensation of warmth, which, if the dose is somewhat large, may be attended with epigastric uneasiness or oppression. The secretions are notably increased, especially that of the bronchial tubes, and other mucous membranes. Diuresis and perspiration are also frequently induced, and menstruation is said to be promoted. Very freely taken, the salt is apt to operate

on the bowels; but, in small doses, is said rather to favour constipation than otherwise. The pulse is either diminished in frequency, or not affected.

With these effects, there is an alterative influence, exhibited in the resolution of tumefactions, and the softening of indurations, which may be attributed to a stimulant influence on the ultimate cell-action, resembling that of mercury and iodine.

In over-doses, sal ammoniac is said to occasion vomiting and purging, with other symptoms of gastro-enteric inflammation. On the inferior animals it has been found, when very largely given, to produce poisonous effects, consisting in inflammation of the alimentary canal, and great disturbance of the nervous system, as indicated by convulsions, paralysis, and coma. It has been asserted, moreover, to cause inflammation of the stomach in these animals, when introduced largely into the circulation through any other avenue.

I have met with no account of fatal effects from it in man: but it might, no doubt, prove poisonous in a very large quantity, taken at one dose. Sundelin states that its long-continued use disorders digestion, but does not produce general cachexia. He had given it for months, in large doses, and seen no other ill effects than those exhibited by the digestive organs. (Sundelin, quoted by Pereira, *Mat. Med.*, 3d ed., p. 448.) The salt is asserted to have entered the circulation, and to have escaped by the emunctories unchanged, when taken in large quantities.

From what has been stated, the inference will be drawn that muriate of ammonia may be given pretty freely, when it may seem to be indicated, without apprehension of serious consequences; the simple rule being observed, to restrain it within the point of producing gastro-intestinal irritation.

Therapeutic Application. It is uncertain when sal ammoniac first came into use as a medicine. It was probably known to the ancient Egyptians; but we have no positive evidence of the fact. Its authentic history ascends only to the period of the Arabians. At present, though comparatively little employed in this country or in Great Britain, it is much used on the continent of Europe, especially by the German physicians, who esteem it very highly. The main purposes which it is thought to answer are, to stimulate the secretions, and, through its alterative properties, to promote the resolution of tumefactions and indurations, and obviate chronic inflammation.

It is given in all *febrile diseases*, after the subsidence or reduction of excitement, in which the secretions are scanty, and the depuration of the blood imperfect; and especially when there is an indication for an increase of the mucous secretions, or for an alterative influence on diseased mucous membranes.

In *inflammations*, too, it is looked on as a most valuable resource, being given in the advanced stages, under the same circumstances precisely as those which, with us, are usually considered as indicating the use of mercurials. It is believed to act favourably by promoting the secretions, modifying the disposition to fibrinous exudation, and hastening the absorption of the fibrin already exuded. Acute *inflammations of the air-passages*, *of the gastric mucous membrane*, and of *the urinary passages*, *pleuritis*, *peritonitis*, and *pneumonia* are among the complaints in which it has been specially recommended. In *pneumonia* it is believed to promote the resolution of the hepatized lung. In *pseudo-membranous croup*, and *bronchitis of the same character*, it is thought to favour the loosening and expulsion of the false membrane, as well as to modify the tendency to its formation. But, in all these inflammations, it should be preceded by the necessary depletory measures.

It is considered to be still more applicable to *chronic inflammations* than to the acute. In *bronchitis*, with thickening of the mucous membrane or copious mucous secretion, in *pyelitis* and *catarrh of the bladder*, and in *leucorrhœa* from chronic inflammation or ulceration of the uterus or vagina, it is deemed peculiarly useful; as also in the inflammations attended with induration or enlargement, as chronic *pneumonia*, *hepatitis*, and *splenitis*.

It has, moreover, been found useful in non-inflammatory *enlargements of the liver and spleen*, *in uterine and ovarian tumours*, and in *abdominal tumefaction with disease of the mesenteric glands*.

In short, muriate of ammonia would seem to rank, among the Germans, in its remedial powers, along with iodine and mercury.

It has proved successful in certain cases of *neuralgia*, has been practically recommended in *hemicrania*, and, in consequence of a supposed excitant influence over the uterus, has been considerably used as an *emmenagogue*.

The *dose* is from five to thirty grains, repeated every two hours, and increased if necessary. When a refrigerating effect is required in the stomach, it may be given in powder, with sugar or syrup; otherwise, dissolved in sweetened and aromatized water.

Externally, it is occasionally used for obtaining the effects of cold, which it produces when dissolving. For the method of preparing a frigorific mixture with this salt and nitre, see *vol.* i., *p.* 107. Introduced into a bladder, it may be substituted for ice, in cases of vascular determination to the brain, hernial tumours, &c.

In *powder*, sal ammoniac is sometimes used as a sternutatory, and in *solution* as a gargle in *chronic and ulcerative angina*, and as a *discutient lotion* to the surface. The solution may be made of different strengths, according to the effect desired, varying from half an ounce to two ounces in a pint of water, or of a mixture of water with one-quarter of its bulk of alcohol. In this way, it is used in *enlargements of the absorbent glands, scrofulous swelling of the knee and other joints, enlarged thyroid, hydrocele, sprains, bruises*, &c.; being applied upon cloths saturated with it, or as a lotion. It is also much used in weaker solution, of from one to four drachms in the pint, as a gentle stimulant, in *ulcers* and *cutaneous eruptions*.

A *rubefacient plaster* may be made, by melting together half an ounce of lead plaster and two drachms of soap, and, when the solution is nearly cold, rubbing with it half a drachm of sal ammoniac. The ammoniacal salt is decomposed, with the gradual escape of ammonia, which is the real rubefacient agent.

IX. CHLORATE OF POTASSA.—POTASSÆ CHLORAS. *U. S., Lond., Dub.*

Preparation. This salt is prepared in several methods, the simplest of which is to pass chlorine through solution of potassa to complete saturation. Two salts are ultimately formed, chloride of potassium and chlorate of potassa; the former by the combination of a portion of the chlorine with the potassium of a portion of the potassa; the latter by the union first of the liberated oxygen of the potassa with another portion of the chlorine, and then of the chloric acid thus produced with the undecomposed portion of the potassa. The chlorate, being least soluble, separates by crystallization; the chloride remaining in solution. For an account of other processes, the reader is referred to the U. S. Dispensatory.

Sensible and Chemical Properties. Chlorate of potassa is in white, shining, anhydrous crystals, inodorous, of a cooling, saline, somewhat sharp and disagreeable taste, soluble in about 16 parts of water at 60°, and much more soluble in boiling water. Like nitre it parts readily with oxygen, and consequently supports combustion. By heat it gives up the whole of its oxygen, and is converted

into chloride of potassium, which may be known by the usual tests for its two constituents.

Effects on the System. These have not been very carefully studied; but, so far as they are known, the salt appears to be refrigerant, somewhat diuretic, and alterative to the blood. Its solution, thrown into the veins of a dog by Dr. O'Shaughnessy, was found to change the dark colour of the venous blood to scarlet; and, according to Dr. Stevens, its internal administration has the same effect of reddening the blood, as shown by the colour of the gums. After having been swallowed, it has repeatedly been detected unchanged in the urine; so that a portion of it, at least, after entering the circulation, escapes decomposition. It is supposed by some to possess resolvent and antiphlogistic properties; but these have not been satisfactorily demonstrated; though it may very possibly act as an arterial sedative, and thus prove useful in inflammation, like nitrate of potassa, to which it bears considerable analogy in several respects.

Therapeutic Application. This salt was first employed as a medicine, under the impression that it might prove useful by imparting oxygen in certain putrid or malignant affections, which were conjectured to owe their malignancy to a deficiency of that element. Among these was scurvy, which appeared to be benefited by the remedy in some cases. But this view of its operation has now been generally abandoned, though the medicine is still employed with apparently good effects in the same diseases. That it does beneficially modify the state of the blood in some of these affections is highly probable; but in what manner it produces this effect is not known, and we must be content, in the present state of our knowledge, with considering it merely as an alterative. After all, it is by no means certain that it may not prove useful, as originally supposed, by oxygenizing the blood and the tissues; for, though a portion of the salt has been detected without alteration in the urine, it has not been shown that the whole of it thus passes; and it would not be at all likely to escape change altogether, considering the great facility with which it yields oxygen to substances having an affinity for that element.

The complaints in which it has been used, with most supposed advantage, are those in which a depraved state of the blood shows itself by malignant typhoid symptoms, and a disposition to phagedenic ulceration, and gangrene.

Scurvy has been mentioned among those in which it has proved useful. Should Dr. Garrod's view of the nature of this affection,

that it is connected essentially with a deficiency of the salts of potassa in the system, prove to be well founded, the beneficial effects of the chlorate of potassa will be readily explicable.

In *febrile diseases of a low type*, especially those in which there is a tendency to gangrene or destructive ulceration, it has been much used and highly commended. Among these are *scarlatina*, *small-pox* in its advanced stages, and *malignant erysipelas;* in all of which it is used internally, and locally as a wash, when ulceration or gangrene has taken place. It might be very appropriately tried in that low febrile condition, attended with a disposition to purulent deposits, and a feeble erysipelatoid inflammation, which is variously considered as *metastatic abscess*, *phlebitis*, and *purulent infection* of the blood.

Another complaint, in which it seems to have proved efficacious, is that *ulcerative affection of the mouth and fauces*, frequently attended with false membrane, not unfrequently ending in *gangrene*, sometimes *gangrenous from the outset*, and *always characterized by a foul breath*, which is peculiarly apt to attack children badly fed, or in other ways debilitated. In the year 1844, Dr. Sayle reported, in the *London Medical Times*, two severe cases of the disease, occurring in young children, which rapidly recovered under the daily use of about a drachm of the chlorate, given in divided doses. Drs. Hunt and Hawkins afterwards imitated and recommended the practice, advising from a scruple to a drachm of the medicine to be administered in twenty-four hours. Still further testimony to the same effect has been subsequently given; and there can be little doubt of the usefulness of the remedy.

In other ulcerative affections, it seems to have been found equally efficacious. In *mercurial stomatitis*, it has recently been employed with great success, both in adults and children, by MM. Herpin and Blache, who found it to act with wonderful rapidity in the cure of that affection; and M. Blache also confirms the preceding testimony of the extraordinary efficacy of the remedy in the ulcerative pseudomembranous complaint referred to in the preceding paragraph. He is also disposed to recommend it in ordinary *pseudomembranous angina*, but does not speak of it with the same confidence. (*Archives Gén.*, Avril, 1855, p. 477.)

Mr. Stanley, of London, is said to use the remedy internally in the *phagedenic ulcerations of syphilis*. (*Lond. Med. Times and Gaz.*, May, 1855, p. 504.)

In *gangrene of the lungs*, and other spontaneous gangrenous affec-

tions, it might be conjoined with other remedies with reasonable hope of benefit.

In *epidemic cholera* it has been strongly recommended, and much used, in connexion with other salts, especially chloride of sodium and carbonate of soda, with the object of restoring a due saline condition to the blood. It is employed by the mouth, by the rectum, in the form of a bath, and by injection into the veins. How much of any supposed advantage is owing to the chlorate of potassa, it would be difficult to determine.

The *dose* is from ten to thirty grains, which may be repeated every two or three hours, so as to amount in the twenty-four hours to two drachms or more for an adult, and from half a drachm to a drachm for a child. It should be given dissolved in two or three fluidounces of water.

Topically, the salt is used as a mouth wash or gargle in ulceration of the mouth and fauces, as an injection in ozæna, and as an application to indolent and phagedenic ulcers of the surface, and to cancerous sores, which it is said to cleanse. For this purpose, a solution may be used containing from one to four drachms in a pint of water.

V. SULPHUR. *U. S., Lond., Ed.*

WASHED SULPHUR.—Sulphur Lotum. *U. S.*

Origin. Sulphur is obtained for medical use from volcanic districts, where the ground is in many places richly impregnated with this substance, sublimed from the interior of the earth. It is separated by sublimation or distillation from the earthy matters containing it, and is afterwards purified by a new sublimation or distillation; in the latter case, being run into cylindrical moulds when melted, and constituting the *roll sulphur* or *stick brimstone* of commerce; in the former, condensed immediately from vapour into a crystalline powder, commonly called *flowers* of sulphur. In the latter state, it is the *sulphur* of the U. S. Pharmacopœia. This, however, is still not quite pure; always containing a small proportion of sulphuric acid, resulting from the oxidation of sulphur in the process. For external use the impurity is rather an advantage than otherwise; but, when intended to be given internally, the ordinary flowers of sulphur should be well washed with hot water, in order to separate the acid. Thus prepared, it is

denominated in our Pharmacopœia, *washed Sulphur* or SULPHUR LOTUM, and is the form always intended in the following observations, when reference is had to the internal use of the medicine.

Sensible and Chemical Properties. Sulphur is in the form of a yellow crystalline powder, inodorous under ordinary circumstances, but of a slight peculiar smell when rubbed or heated, of a feeble peculiar taste, insoluble in water and alcohol, but dissolved by alkaline solutions, and by the fixed and volatile oils, especially with the aid of heat. It is volatilizable, fusible, and combustible; beginning to rise into vapour at 180° F., melting at 225°, and boiling at 600°. It burns with a blue flame, and yields as the product of its combustion, sulphurous acid gas, easily known by its very peculiar pungent smell, and irritating effects in the nostrils. Sulphur is ranked among the elementary bodies.

Effects on the System. In its local effects, sulphur is very slightly irritant. Taken internally, in a very small dose, it produces no sensible effect; but, in the quantity of a drachm or more, it usually operates as a laxative, often producing slight griping pains. In its capacity of a cathartic, however, I shall treat of it hereafter. It is said that, in the lower animals, it has proved fatal, when given in excessive quantities; producing inflammation of the stomach and bowels. In experiments upon horses, in the veterinary school at Lyons, it was found that one pound destroyed life. It is said also, in very large doses, to have caused gastro-enteritis in man.

Hitherto we have been considering only its local effect. It has indeed, been questioned whether it is capable of acting on the system at large. Of this, however, it appears to me that there can be no reasonable doubt. Even when producing no obvious effect in health, it operates not unfrequently with a favourable influence on disease; but, if the condition of the system be carefully observed, after a short period of its continued use in alterative doses, evidences of its action will be detected. A sulphurous odour generally exhales from the body under these circumstances; and the same smell can be detected in various secretions, as the sweat, urine, and milk. Sometimes, when the medicine has been long continued, this odour is very strong. Besides, a slight increase of the secretions themselves may often be noticed, especially those of the skin and bronchial mucous membrane; and it is said that some increase in the frequency of the pulse and temperature of the surface, showing a gentle excitement of the circulatory system, is often observable. Another and positive proof that it has entered

the system is afforded by the blackening of silver worn in or about the body, as silver coin or a watch; and it is asserted that the skin itself sometimes at length assumes a yellowish hue. Sulphur has, moreover, been detected, combined with oxygen or one of the alkaline metals, in the urine. Thus, it was found by Dr. Griffiths that the proportion of sulphuric acid, contained in the urine in health, was more than doubled under the internal use of sulphur; and Wöhler noticed that the urine of dogs, under its influence, yielded sulphuretted hydrogen on the addition of muriatic acid, proving the presence of a sulphuret.

Mode of Operation. From what has been above stated it follows, that sulphur is absorbed into the circulation. But, considering its perfect insolubility in water, how are we to explain this result? Simply by the influence of the alkaline matter contained in the alimentary canal, either secreted with the mucus, or forming a part of the bile thrown into the duodenum. It has been already stated that sulphur is dissolved by alkaline solutions. The solution is effected through a chemical change, by which the sulphur is partly oxidized at the expense of the alkali, and partly combines with the liberated metal, the sulphur acid which is formed combining with another portion of the alkali to form a sulphite or sulphate. Both these compounds, the sulphuret, namely, and the sulphite or sulphate, are soluble in water, and consequently absorbable; and it is in these states of combination, probably, that the sulphur circulates in the blood. The odour of the exhalations from the body is probably owing to the decomposition of the sulphuret, as it reaches the surface, and the evolution of sulphuretted hydrogen, either through the influence of the atmosphere, or of the acids, simultaneously secreted. When the sulphite is absorbed, it must speedily pass into the condition of sulphate by combining with the oxygen of the blood; and it is in this state that it is generally eliminated with the urine. It is thus obvious that the same effects are produced by sulphur on the system, as by sulphuretted hydrogen or the sulphurets, and probably also sulphurous acid and the sulphites, when taken internally in small doses.

Therapeutic Application. Sulphur has been used as a medicine both internally and outwardly from ancient times. It was formerly supposed to act favourably in *phthisis;* but the notion of its usefulness in that affection probably originated in the imperfect means of diagnosis possessed by our predecessors, and has been generally abandoned. At present it is employed as an alterative, and gentle

stimulant of the secretions, in *chronic rheumatism*, *chronic and irregular gout*, various *cutaneous diseases*, old *paralytic cases*, and different forms of *neuralgia*. It is particularly adapted to these different affections when attended with constipation; as, in connexion with its alterative effects, it can be so administered as to maintain the bowels in a wholesome laxative state. A full purgative effect should be avoided, when the sulphur is given to influence the system.

Of the above mentioned affections, *chronic rheumatism* is probably that in which it displays its best powers as an internal remedy. It is wholly unsuited to cases having any activity of inflammation, and should not be administered during the existence of febrile heat, or circulatory excitement. In *chronic gout* it is of much more uncertain efficacy, though probably not without occasional good effect, especially in its nervous forms.

In *chronic catarrh*, particularly attended with excessive and exhausting expectoration, it acts beneficially probably by a direct stimulant and alterative influence on the diseased membrane. It has, from the earliest times of its employment, had some reputation in bronchial diseases. *Asthma* ranks among those supposed to be benefited by it; but that it is capable of exercising any decided influence over the paroxysms of spasmodic asthma, whether in preventing or arresting them, would scarcely be maintained at present. Different affections were formerly often confounded under this name; and it was sometimes applied to simple chronic bronchitis, attended with dyspnœa. It was probably in cases of this kind that sulphur proved useful.

Much of the reputation of sulphur, as an internal remedy in *skin affections*, is owing to its extraordinary influence over a special eruption when locally applied. Now that it is believed to operate, in scabies, by a direct poisonous action on the parasitic animalcule on which that disease depends, and not by an alterative influence on the skin, which might readily be supposed to extend to other cutaneous affections, it is not so much relied on as formerly, as an internal remedy in those diseases generally. Nevertheless, the fact seems to be, that it has a real influence over the cutaneous functions, as over those of the bronchial mucous membrane, and operates on cutaneous eruptions as it does on chronic catarrh, with a certain degree of efficiency. Even in scabies, it is supposed to have some effect when taken internally; the sulphuretted hydrogen developed upon the surface of the body, being perhaps poisonous to the insects. The cutaneous affections in which, after scabies, it is thought to be

most effective, are *porrigo*, *chronic eczema*, and *chronic impetigo;* but it may be used in any one of them, in which general excitement is wanting, and the local affection has subsided into the obstinacy of habitual wrong action, with little or no tendency to acute inflammation.

Besides the complaints mentioned, sulphur has been used as a supposed antiperiodic, with considerable asserted success, in *intermittent fever*, the *hectic paroxysm*, and *periodical neuralgia;* as an alterative in *scrofula* and *secondary syphilis;* as an emmenagogue in *amenorrhœa*, and as an anthelmintic against *worms in the bowels.*

It is used in substance both internally and externally, and in the latter mode also in the form of vapour. There are, moreover, various chemical preparations of it, which exercise an alterative influence identical with that of sulphur, and the consideration of which, therefore, belongs to this place. I shall treat first of the forms in which sulphur is used with little or no change, and afterwards of its chemical preparations.

Administration. Sulphur is usually given in powder, the dose of which, for the alterative effects of the medicine, is from one to two scruples three or four times a day. It may be administered mixed with syrup, or molasses, or stirred up with milk.

Sulphur Ointment (UNGUENTUM SULPHURIS, *U.S.*) is made by simply rubbing together one part of sulphur and two parts of lard, until thoroughly mixed. For this purpose the unwashed sulphur is considered preferable; as the small portion of acid contained in it may add to its efficiency. This ointment is an almost certain remedy for scabies. It should be thoroughly applied to every part of the body affected; and, when the disease is diffused, the application should extend to the whole surface. It may be used daily, at bedtime; the patient being anointed in a warm room, allowed to sleep in his unctuous coating, and in the morning washed clean in a bath, or with soap and water. I have usually found four such applications, if thoroughly made, sufficient; but sometimes the affection is not completely eradicated; requiring renewed applications, or the use of some other preparation to effect a permanent cure. A little oil of lemons or of bergamot may be added to the ointment, to conceal in some measure its disagreeable odour.

Various *compound ointments* have been recommended, containing, in addition to the sulphur, other substances poisonous to the insect, and some odorous substance to cover the smell. Our officinal *Compound Sulphur Ointment* (UNGUENTUM SULPHURIS COMPOSITUM,

U. S.), besides sulphur, contains ammoniated mercury, sulphuric and benzoic acids, nitre, and oil of bergamot. The London College directs a compound ointment containing sulphur, white hellebore, nitre, and soft soap, with lard. These may possibly be somewhat more efficacious than the simple ointment; but they are much more irritant to the skin.

In the Paris hospitals, they make much use of sulphur ointment containing an alkaline ingredient. A preparation famous by the name of "*Pommade d'Helmerich*," contains two parts of sulphur, one of carbonate of potassa, and eight of lard. Another formula directs fifteen parts of sulphur, five of common salt, and one hundred and twenty-five of lard. This is used at the hospital Saint Louis, where the patient is put into an alkaline bath in the evening, next day is rubbed over the whole body, every six hours, with the ointment, on the third day takes another bath, and is not allowed to put on his clothes until they have been well baked, so as to destroy the insect and its eggs. Two days of treatment are said to be sufficient to effect a cure. A sulphurous bath is sometimes substituted for the alkaline bath.

Instead of employing the ointment, some practitioners content themselves with directing their patients to sleep between sheets, which have been well strewed over with the flowers of sulphur.

Some combine the internal with the external use of the sulphur: but it is very doubtful whether the cure is in any degree hastened: or rather it is pretty certain that it is not.

These sulphur ointments are also frequently used in the treatment of other eruptions, especially the eczematous and impetiginous, in their most chronic forms. In porrigo or tinea capitis, a mixture of equal parts of sulphur and tar ointments has been sometimes used with advantage.

The following are the chemical preparations of sulphur in more or less general use.

I. PRECIPITATED SULPHUR.—SULPHUR PRÆCIPITATUM. *U. S., Lond.—Milk of Sulphur.—Lac Sulphuris.*

Precipitated sulphur is made by boiling sulphur and lime together in water, filtering, and then precipitating with muriatic acid. Certain chemical reactions, between the lime and sulphur, through which both are dissolved, are inverted by the muriatic acid, which reacts with the ingredients of the lime so as to form chloride of calcium and water, while the sulphur is separated and deposited, carrying with it a portion of loosely combined water.

Precipitated sulphur is in the form of powder or pulverulent lumps, of a whitish colour, soft to the touch, not gritty between the teeth like the flowers, of a feeble odour, and a slight sulphurous taste. Its properties are not materially different from those of the sublimed sulphur. It was at one time supposed to be a hydrate; but, when thoroughly dried, it contains very little if any water; certainly not enough to form an equivalent combination with the sulphur. According to Berzelius, it becomes yellow when melted, giving out a little sulphuretted hydrogen; to the presence of which, therefore, the colour has been ascribed.

It is very apt to contain sulphate of lime, arising from the use of sulphuric acid as the precipitant instead of muriatic acid, the former giving rise to a nearly insoluble, the latter a very soluble compound. The presence of this impurity may be suspected, when the preparation is of a purely white colour. It is left behind when the sulphur is either burned or volatilized.

The effects, therapeutic uses, and dose of the precipitated sulphur are the same as those of the flowers; and its only advantage is its more impalpable condition, and probably somewhat greater facility of being acted on in the primæ viæ, so as to become absorbable.

II. SULPHUROUS ACID.—ACIDUM SULPHURIOSUM.

Though not recognized as a distinct medicine, this is an agent through which certain valuable effects of sulphur are obtained, and consequently demands a brief notice. It is a gaseous substance, resulting from the combustion of sulphur, having a pungent, disagreeable, suffocating odour, familiar to all who have ever been in the vicinity of a common sulphur-match when burning. Water absorbs it very largely, forming liquid sulphurous acid. It is quite irrespirable in its pure state, causing a spasmodic closure of the glottis. Diluted with atmospheric air, it is admitted into the air-passages, where it acts as a powerful irritant, endangering life by bronchial and pulmonary inflammation.

In former times, the fumes of burning sulphur were used as a disinfectant, but it is doubtful whether they possess any power of this kind; at least they are much inferior to chlorine, by which they have been entirely superseded.

They are occasionally applied to the nostrils, for the purpose of making a strong irritant impression, and thereby exciting the cerebral centres, in cases of threatened or existing syncope or asphyxia. Care, however, must be taken not to apply them too freely, lest

inflammation might be induced, or spasm of the glottis brought on at the time of revival.

But the chief use of sulphurous acid gas is in the *sulphur vapour bath.* The patient is inclosed in a perfectly air-tight box, made for the purpose; his head projecting, and the aperture around the neck thoroughly closed. Some sulphur is placed upon a piece of heated iron within the box, where it burns, filling the space around the patient with its gaseous product; or the gas is introduced by means of a tube, connecting with a small outer furnace, in which sulphur is undergoing combustion. The effect of the gas is to produce heat, itching, prickling, and pain. It probably operates more by a direct alterative or stimulant influence on the skin than through absorption. It has been used for the cure of *scabies*, which it will usually effect; in other obstinate skin diseases, as *chronic eczema*, *impetigo*, *prurigo*, &c., and in various constitutional affections, as *chronic rheumatism*, *scrofulous complaints*, *old palsies*, and *obstinate neuralgia.*

As sulphurous acid is a powerful poison to plants, its aqueous solution ought to be efficient in the treatment of the cryptogamous skin affections, as *porrigo* or *favus*, *trichosis* or *ringworm of the scalp*, *mentagra* or *sycosis*, and *pityriasis versicolor*, which have all been shown to be at least essentially associated with, if not dependent on, microscopic fungi.

The *alkaline sulphites* have been employed as parasyticides. At the suggestion of Professor Graham, Dr. Jenner, of London, gave *sulphite of soda* in the dose of a drachm, three times a day, in yeasty vomiting, with the view of destroying a microscopic fungus, called *sarcina ventriculi*, which was known to be associated with the affection, and with the desired effect, so far as the destruction of the plant was concerned, though the disease was not cured. The sulphites act by the decomposition produced by acid in the stomach, the sulphurous acid being liberated. When applied as a local remedy, in the above mentioned cutaneous affections, they should be used in solution with an acid—the acetic, for example—by which the same end may be effected.

III. HYDROSULPHURIC ACID or SULPHURETTED HYDROGEN.—ACIDUM HYDROSULPHURICUM.

Like the preceding agent, this holds no place in the U. S. or British officinal catalogues; but, being an efficient remedy, under certain circumstances, requires notice. At ordinary temperatures it is gaseous, extremely fetid, and fatal to animals if respired. Water has considerable affinity for the gas, absorbing twice or

three times its own bulk, and acquiring its offensive smell, with a disagreeable sulphurous taste.

Water saturated with the gas, when taken internally in moderate doses, produces the same alterative effects on the system as sulphur, increasing the various secretions, moderately exciting the circulation, and operating as an alterative in similar affections. Indeed, the great probability is, that sulphur and sulphuretted hydrogen enter the system from the stomach and bowels in the same state of chemical combination, resembling in this respect chlorine and hydrochloric acid. When taken in great excess, however, similarity of action between it and sulphur ceases; for it is scarcely possible that the latter, no matter in what quantity it might be administered, could undergo in the stomach an amount of change, which would equalize its effects with those of sulphurretted hydrogen largely administered. I have before stated that this, when inhaled in its gaseous form, is very poisonous. Air moderately contaminated with it causes nausea, headache, and general weakness; more strongly, convulsions; and still more strongly, great general depression, and loss of sensibility. It blackens the blood, and probably acts injuriously by depraving that fluid, as well as by a direct stupefying influence on the brain. Taken somewhat copiously into the stomach, in the liquid state, it produces gastric irritation, with nausea and vomiting; and, very largely swallowed, is said to act in the same manner as when inhaled, probably because its quantity is now beyond the protecting power of the alkaline matter, which it encounters in any attempt to enter the circulation. As a medicine, it has been given in the quantity of half a pint or a pint in twenty-four hours, in divided doses.

But sulphuretted hydrogen is interesting, in a therapeutic point of view, chiefly as the active constituent of natural sulphurous waters, and as being the main agent in the therapeutic operation of artificial sulphur baths.

Natural sulphurous waters have long been celebrated for their efficacy in numerous morbid conditions. They are used internally, and externally by local and general bathing. No doubt, much of their reputed effect is ascribable to the circumstances under which they are used at watering places; the comfort of relaxation, the pleasures and excitements of social intercourse, the influence perhaps of novelty, the fine scenery of the environs, pure air, exercise, &c.; but, all these abstracted, much is still left which can be ascribed only to the effects of the waters. Of the special

application of this remedy, I shall treat under the following head; merely observing further, in this place, that our country abounds with natural sulphur waters, and often in situations where all the accessary advantages, above referred to, conjoin with their medicinal influence to act favourably on the health. Among them may be particularized the famous *White*, *Salt*, *Red*, and *Blue Sulphur Springs* among the mountains of Virginia, the *Blue Lick Springs* in Kentucky, and those of *Sharon* and *Avon* in New York.

One important point in relation to the sulphurous waters is, that they should not be taken internally when the stomach is in a state of vascular irritation, or disposed to it; nor applied externally in a febrile condition of the system, or during the existence of acute inflammation of any one of the important organs. Caution even is required in cases of imperfect convalescence from these states, lest a return of them might be provoked.

IV. SULPHURET OF POTASSIUM.—POTASSII SULPHURETUM. *U. S.*, *Lond.*, *Ed.*—HEPAR SULPHURIS. *Dub.*—*Liver of Sulphur.*

Origin and Properties. This is prepared by melting together sulphur and carbonate of potassa. The carbonic acid escapes, and the sulphur and potassa mutually react so as to produce sulphuret of potassium and sulphate of potassa, which are, therefore, the ingredients of the preparation. The sulphuret contained in it, and upon which its peculiar medical virtues depend, is supposed to consist of three equivalents of sulphur and one of potassium, and consequently to be a tersulphuret of potassium. In the recent state, it is of a liver-brown colour, which has given rise to its ordinary name. When perfectly dry, it is inodorous; but, if moistened, it acquires a slight smell of sulphuretted hydrogen. Its taste is acrid, alkaline, bitter, and very disagreeable. It is dissolved by water, forming an orange-coloured solution, which slowly evolves sulphuretted hydrogen, probably through the action of the carbonic acid of the air. Almost all acids decompose it, with the formation of sulphuretted hydrogen, and the deposition of the excess of sulphur. By exposure to the air, it absorbs oxygen, the sulphuret is changed successively into the hyposulphite, sulphite, and sulphate of potassa, and the colour becomes green, and ultimately whitish.

Effects on the System. The effects of sulphuret of potassium appear to be combined of those of an alkali, and those of sulphur or of sulphuretted hydrogen. Locally, it is irritant, and applied, in a

concentrated state, to any sensitive surface, whether external or internal, will produce inflammation, and even corrosion. Internally, its immediate effects depend, in some degree, upon the contents of the stomach. If there is acid among them, this is neutralized, a mild neutral salt is substituted for the acrid sulphuret, and sulphuretted hydrogen is evolved. If not, the sulphuret operates directly on the stomach, with an irritant influence proportionate to its quantity, and, being gradually absorbed, produces its effects on the constitution. Under these circumstances, it probably enters the circulation in the condition of sulphuret, and thus reacts with the oxygen of the blood so as to be partly converted into a sulphate, in which state, as well as in its own state unchanged, it is thrown out by the emunctories. Should an acid have been encountered, and sulphuretted hydrogen have been evolved, this is absorbed; but, at the moment of encountering the blood, must react with its soda so as to form sulphuret of sodium, which then acts and is eliminated, in like manner as the sulphuret of potassium just referred to. It seems, then, that, whichever of these preparations of sulphur is taken, whether the element itself, sulphuretted hydrogen, or one of the sulphurets, and whether or not the latter encounters an acid in the stomach, though the degree of local irritant effect may differ, the influence on the system at large is the same, at least from proper medicinal doses.

When taken duly, sulphuret of potassium acts as a moderate stimulant, increasing the frequency of the pulse, heat of skin, and the various secretions, particularly, it is thought, the mucous secretion and that of the liver. Some suppose it to operate with a special influence on the pelvic viscera, determining the menstrual and hemorrhoidal flux; but this, when observed, is probably a mere accidental direction of a general influence.

In over-doses, it irritates the primæ viæ, sometimes producing nausea, vomiting, and purging; and, in large quantities, acts as a violent acrid narcotic poison; death sometimes following in so short a period as fifteen minutes. The symptoms are severe burning pain in the throat and stomach, perhaps vomiting, and speedy and great prostration, attended with convulsions. The best antidote is probably sulphate or acetate of zinc, with free dilution. A joint emetic and antidotal effect might be expected. The state of system remaining must be met, in accordance with the obvious indications.

Therapeutic Application. Carefully administered, sulphuret of potassium may prove useful in the complaints before mentioned as

being benefited by the use of the sulphur. It has been particularly recommended in chronic affections of the mucous membranes, attended with copious muco-purulent discharges, such as *chronic bronchitis*, *catarrh of the bladder*, &c. In common with other alkaline sulphurets, it has been used in *pseudomembranous croup*, in the hope of modifying the plastic secretion, and thus favouring the expulsion of the membrane; but the results have not been such as to encourage its further employment. Indeed, the medicine is at present almost never prescribed internally; as all its good effects can be obtained by milder remedies, less disposed to irritate the stomach, and less dangerous in over-doses.

The *dose* is from two to six grains, which may be given dissolved in from four to eight fluidounces of sweetened and aromatized water, and repeated twice daily. It may also be administered in pill, which, however, is a less eligible form.

External Use. It is chiefly as a topical or external remedy, that sulphuret of potassium is now used. It may be applied in the form of ointment, lotion, or bath.

The *ointment* may be made by rubbing half a drachm of the sulphuret with an ounce of lard. It may be used in cutaneous eruptions, as *scabies*, *psoriasis*, *pityriasis*, and the *chronic and dry states of eczema and impetigo.*

Lotions may be made of various strengths, from one drachm or less to two drachms to the pint of water. These are employed in the cutaneous affections just mentioned, and also for injection into the *nostrils*, *ears*, *vagina*, *urethra*, and even the *rectum*, in *chronic muco-purulent discharges* from these parts.

The *bath* is a much more important remedy. *Artificial sulphurous baths* generally consist of a solution of this salt, or of sulphuret of sodium, which so precisely corresponds in effect with the analogous compound of potassium, that what is said of one may be considered as belonging equally to the other. I shall first treat of the effects of these baths, and then of their application. They are usually applied warm, or in various degrees hot; as the effect to be produced is essentially excitant, and consequently is favoured by an elevation of temperature.

Considerable irritation of skin is produced, which reacts on the system, and joins with the heat, and the constitutional influence of the medicine, to cause a general excitement, sometimes amounting to fever. In some persons, this is so readily induced as to render them unfit subjects for the remedy. Not unfrequently the irritation

of skin, especially if the solution be strong, the temperature high, and the period of immersion protracted, is attended with a papular or vesicular eruption, which is occasionally extensive and painful. This effect is by some administrators of the remedy considered as essential to its full favourable operation, and is aimed at as the *sine qua non* in the therapeutics of sulphurous bathing. It is supposed to constitute a sort of crisis, to be an indication of the escape of offensive humours, and must be produced at all events. Perhaps these relics of old times may find advocates in the revived humoralism of the day; but, whatever may be the theoretical views on the subject, care should be taken not to urge their application too far; as some persons obstinately resist this effect of the remedy, and might suffer seriously, if the bath were strengthened, and persevered in without limits, under the impression of its necessity. I presume most therapeutists would agree with me in considering this affection of the surface as a mere result of irritation, and as useful no further than as it might act revulsively against interior diseases, or supersedingly on those of the skin itself.

If the object, in the bathing, be more to bring the system under the sulphurous influence than to irritate the surface, it may be accomplished by the addition of a small quantity of sulphuric or muriatic acid, which will evolve sulphuretted hydrogen, and substitute a mild neutral salt for the acrid and irritating sulphuret. Care, however, must be taken to stop short of the point of saturation, if any effect on the surface is to be produced. When the acid is used, a portion of sulphur is precipitated, as well as of sulphuretted hydrogen evolved.

These sulphur-baths act by producing an excitant effect throughout the ultimate organic structure, substituting a new and self-limited action for that previously existing; perhaps, as in the case of mercury or iodine, changing the very structure itself by stimulating the disintegrating process, and causing a healthier nutritive deposition, in the place of the diseased tissue removed. In other words, they are an alterative remedy. This influence is felt especially in the skin, and it is here, consequently, that their curative effects are most obvious. But, beside this alterative operation, they act revulsively, in relation to internal diseases, by the irritation they produce upon the surface.

The complaints in which they are perhaps most beneficial are all *old, obstinate cutaneous eruptions*, in which the skin has become organically changed by the disease, with little or no remaining tend-

ency to active irritation or acuteness of inflammation. *Lepra*, *psoriasis*, *pityriasis*, *old eczema* and *impetigo*, and *obstinate prurigo*, are examples of the kind. *Scabies*, too, almost always yields to this remedy.

Under sulphur, the various general or constitutional diseases have been mentioned in which the baths are most used. *Chronic rheumatism*, *irregular and chronic gout*, *chronic mucous inflammations*, whether of the bronchia, the stomach and bowels, or the urinary and genital passages, consequently chronic *catarrh*, *cystirrhœa*, *leucorrhœa*, *diarrhœa*, and *dysentery*, *scrofulous affections without fever*, and *secondary syphilis*, constitute a catalogue of maladies, offering abundant opportunities for the beneficial influence of this therapeutic measure. *Inertness of the liver*, and *amenorrhœa* are often also benefited by the stimulant influence extended to the hepatic and uterine functions respectively.

Another important application of the sulphurous baths is to obviate the poisonous effects of lead on the system. But enough has been said on this subject under lead. (See *vol.* i., *p.* 150–1.)

Contraindications are offered, as before stated, by fever, acute inflammations, and tendencies to high vascular irritation; and, whenever the bath is observed to develop these conditions, it should be suspended for a time, or abandoned.

The ordinary strength of the bath is four ounces of the sulphuret to thirty gallons of water; but, to meet special cases, it may be diminished down to two ounces or increased to six. The patient may remain in the bath from half an hour to two or three hours; and the bathing may be repeated daily, or less frequently as the case may require. Care should be taken, when an acid is added, that sulphuretted hydrogen should not be so copiously evolved as to occasion serious inconvenience if inhaled. The bath should be prepared in a wooden tub.

VI. COLCHICUM.

COLCHICUM ROOT.—Colchici Radix. *U. S.*—Colchici Cormus. *Lond.*, *Ed.*

COLCHICUM SEED.—Colchici Semen. *U. S.*, *Lond.*—Colchici Semina. *Ed.*

Origin. Colchicum is the product of *Colchicum autumnale*, a beautiful little plant commonly called *meadow saffron*, which grows wild

in Europe, where it is also cultivated for medical use. The root, or, in botanical language, the cormus, formerly called the bulb, is in perfection in the summer, near the close of which it puts forth an offset, which grows at the expense of the maternal cormus, and sends up flowers in the autumn. In the following spring, the old cormus has shrunk considerably, and gradually goes on diminishing till it perishes; while the new one flourishes, sends up the fruit and leaves, and attains its full growth in summer. It is generally thought that the virtues of the root depend very much upon the stage of its growth, and that the proper period for collecting it is from the early part of June to the middle of August; as, before that time, it has not become fully developed, and afterwards deteriorates by giving up its substance to its offspring. All parts of the plant, the leaves, flowers, and fruit, possess medical virtues, as well as the cormus; but it is only this and the seeds that are recognized as officinal.

1. Colchicum Root. When fresh, this is shaped somewhat like the bulb of the tulip, though rather smaller, is covered by a brown membranous coating, is white, solid, and fleshy within, and contains an acrid milky juice. After being dried, and deprived of its coating, which easily separates, it appears rounded on one side, and somewhat flattened on the other, where there is generally a vertical groove running from the top to the bottom of the cormus. Generally, however, before being dried, it is cut into thin transverse slices, sometimes into vertical slices, in which state it is usually kept in our shops. These slices, if tranverse, are circular, with a notch on one side; if vertical, are somewhat heart-shaped. They are somewhat more than a line in thickness; and their cut surface has a grayish-white colour, and starchy appearance. They have little smell, but a hot, acrid, bitter taste, and yield their virtues readily to vinegar, wine, or spirit. They are injured by keeping, and are very apt to be of inferior quality, either from this cause, or from original defect in the cormus. The best test of their efficacy is the degree in which they possess the bitter taste.

Colchicum Seeds. These are collected in the summer, when quite ripe. They are about the eighth of an inch in diameter, of a reddish-brown colour more or less dark on the outside, whitish within, and similar in appearance to the black mustard seed. They are inodorous, and have an acrid bitter taste. Like the cormus, they readily yield their virtues to vinegar, wine, or spirit. They are less apt to suffer deterioration in drying, or by time.

Active Principle. The activity of colchicum depends on a peculiar alkaline principle called *colchicia*, which, when first discovered, was supposed to be identical with veratria, but which Geiger and Hesse demonstrated to be quite distinct. For the mode of preparing it, and its peculiar properties, see the U. S. Dispensatory. Independently of other peculiarities, it differs from veratria in being crystallizable, soluble in water, and destitute of acrid and sternutatory properties. It must be a powerful poison, as one-tenth of a grain killed a young cat in twelve hours. It exists in the seeds and cormus, and probably in all parts of the plant.

1. *Effects on the System.*

Colchicum is locally somewhat irritant; but not violently so. In moderate medicinal doses, it is believed often to act beneficially in disease, without in any discoverable manner deranging the healthy functions. Hence it must be considered as an alterative; and, as it is given with a view more to an influence of this kind than for its sensible effects, it would appear properly to belong to the present class.

More largely given, it produces very sensible and important effects. One of the first and most common of these is nausea: and there are few medicines, the nauseating effect of which is more distressing to the patient. It is also very apt to purge, and in considerable doses to vomit; and, if given to a certain amount, usually produces both active vomiting and purging, with oppressive nausea, and great feelings of weakness and prostration.

When not carried off by purging, it has a tendency to act on the secretions, and may indeed be looked on as a universal secretory stimulant, acting on some one of the functions preferably, or on two or more jointly, according to the special circumstances of the case. It most strikingly affects the skin and kidneys, sometimes producing copious diuresis, sometimes not less copious diaphoresis, being most disposed to the former effect when the patient is about, and drinks freely of cold water; to the latter, when he is warm in bed, and especially when its use is conjoined with that of an opiate, or warm drinks, or both. Occasionally it is said to cause profuse salivation. It is thought also, in some instances, to stimulate the hepatic and bronchial secretions, and to act as an emmenagogue. Some have ascribed to it the property of promoting uterine contraction, and thus hastening protracted labours. These latter effects, however, are only occasional, and cannot be relied on.

Colchicum has been supposed to have the properties of diminishing the frequency of the pulse, and abating pain, by a direct influence, independent of its nauseating or evacuant operation; but though it often undoubtedly produces the effects referred to, it is by no means ascertained that they are not secondary results; and, in relation to the relief of pain, I am quite convinced, from my own observation, that, when experienced, it is always a consequence of some antecedent action. I am, however, disposed to think that the medicine has a sedative influence on the heart, probably through the organic nervous centres.

Sometimes symptoms of nervous disorder are experienced during the action of colchicum, such as headache, and feelings of weakness and depression; but they are not different from what might readily be supposed to depend on nausea, or other gastric disorder.

Certain individuals are extremely susceptible to the influence of colchicum, being much nauseated, vomited, and greatly distressed, by doses which in general produce no sensible effects whatever.

Poisonous Effects. Colchicum is, in large doses, a violent and extremely fatal poison, and numerous instances of death are on record from its having been taken by accident, especially in consequence of mistaking its vinous or spirituous preparations, for wine or ardent spirits. The symptoms almost universally produced are nausea and violent vomiting, usually coming on in about half an hour, followed by excessive purging; and the two continue in general till near the close. Along with them are burning sensations in the œsophagus and stomach, excessive thirst, abdominal pains, tenesmus, feelings of great weakness, and extreme prostration, as indicated by the hurried respiration, the feeble and almost absent pulse, and cold extremities. Death usually occurs within twenty-four hours, and is rarely postponed beyond the second day. In some cases purging is absent. In general, the intellect remains clear till the last, and death is not preceded by convulsions. In a very few instances, headache, stupor, and delirium have been mentioned among the symptoms; but not more frequently, nor in greater degree, than might be referred to the sympathetic effect of the gastro-intestinal disorder. Four autopsies made by Dr. Casper at Berlin, and five by M. Jules Roux at Toulon, gave the following results. The blood was of a dark, cherry-red colour, or like that of currant-jelly, and, according to Dr. Casper, was of a thick consistence. The ascending vena cava was greatly distended with blood in all the cases; the kidneys were much congested; the brain was also congested; but

the lungs were normal. In the cases of Dr. Casper, the right side of the heart was full of blood, in those of M. Roux, that organ was flaccid, and contained a little dark blood sometimes coagulated. The liver was in some instances congested, in others not. In M. Roux's cases the spleen and portal vein were congested; the stomach and bowels were in two of the cases quite normal, in one merely congested, and in the others reddened or much softened, indicating gastro-enteritis, but not ulcerated. The absence of inflammation of the stomach has been noticed in other cases. (*Lond. Med. Times and Gaz.*, June, 1855, p. 605.) Death has been caused, in one instance, by two drachms and a half of the tincture of colchicum: and, in another instance, the same result followed the medical administration of three drachms and a half of the wine. (*Taylor on Poisons.*) In general, more than an ounce of the wine has been taken in the fatal cases.

In the treatment of the poisoning, after the free use of demulcent drinks to wash out the stomach, opiates should be given by the mouth or rectum, strong sinapisms applied over the abdomen, and stimulants, such as wine-whey, administered, if necessary to prevent death from prostration.

Mode of Operation. It is most probable that colchicum produces its effects, even the purging and vomiting, through absorption, the active principle being taken into the circulation, and either operating through the blood directly on the parts affected, or primarily on the organic nervous centres which govern the functions. In favour of this view is the length of time which elapses before the emetic effect is produced, unlike in this respect the operation of the more acrid emetics, as sulphate of copper; the intense nausea and prostration produced by large doses; and the fact stated by Sir E. Home, that by 160 drops of the wine injected into the jugular vein of a dog, the same symptoms of vomiting, purging, and prostration, as from the poison taken into the stomach in man, were observed, and, after death, universal inflammation of the gastric mucous membrane. The increased secretion is the obvious result of the acrid principle introduced into the circulation, and seeking an outlet from the system by the various emunctories.

The absence of symptoms of proper nervous disorder proves that the medicine does not act directly on the cerebral centres, or those of animal life, and that it cannot, therefore, rank with the narcotics. The probability is, that it immediately depresses the heart and lungs, through the nervous centres in the medulla oblongata; and

this depression may be so great, from over-doses, as to suspend the function of these organs. The fatal effects of poisonous doses are more rapid than can be accounted for by the simple impression on the stomach and bowels, which, though sometimes inflamed, are in other instances quite sound; while the most violent and even corrosive action of such medicines as arsenic and the mineral acids, completely disorganizing as they do the gastric membrane, often allow the patient to linger for several days.

Is it possible to approach to a solution of the question, as to the nature of the alterative action of colchicum? Some observations, made upon the character of the urine under its influence, tend to throw light upon the subject. Many years since it was asserted by Professor Chelius, of Heidelberg, that colchicum, given during the existence of gout and rheumatism, occasioned a great increase of uric acid in the urine. This was afterwards stated by Dr. Graves, of Dublin, not to be a constant result; but comparatively recent experiments by Dr. Maclagan, of Edinburgh, tend strongly to confirm the statements of Chelius. Dr. Maclagan examined the urine before and after the use of colchicum, in a considerable number of rheumatic cases, and uniformly found both the urea and uric acid in the urine greatly increased. In two instances, which he reports in detail, the increase was gradual from the beginning to the close of the administration of the remedy. In one case, it was from 10.49 parts of urea and .257 parts of uric acid in 1000 of the urine, at starting, to 17.635 of the former and 1.034 of the latter, on the eighteenth day; in the second case, from 6.358 and .097 in the beginning, to 16.324 and .936 on the twelfth day. Thus, the urea was more than doubled, on the average of the two cases, and the uric acid more than quintupled. At the same time, the blood which, at starting, in one of the cases contained a little both of urea and uric acid, at the close of the experiment did not exhibit a trace of either. (*Ed. Monthly Journ. of Med. Sci.*, N. S., v. 231.) It has been inferred from these observations, that colchicum cures gout and rheumatism by causing an evacuation of the urea and uric acid, existing in the blood in these complaints. I infer something more. The increase was not merely sufficient to deprive the blood of the accumulation, arising from a previously defective elimination; but it was greatly in excess beyond the ordinary normal amount excreted in health. Thus Becquerel states the average urea in health at 12.102 in 1000 and uric acid at 0.398, which is very much less than the amount eliminated in the above cases under the influence of colchicum. It would appear, therefore, that colchicum has the property of increas-

ing the production of urea and uric acid; in other words, of accelerating the process of normal change or disintegration of the tissues; thus assimilating it, according to the views I have presented, to the other great alteratives, which prove most efficient in the treatment of disease. This property of hastening the disintegrating process, seems to be connected with the acrid property, which renders all these bodies more or less stimulant to the secretions in general. The experiments, however, with colchicum, as with the other alteratives in this relation, require extension. Should it be found that an ordinary effect of colchicum is to increase the urea and uric acid in the urine, in health as well as during the existence of rheumatism, the result will be confirmatory of these views.

2. *Therapeutic Application.*

Colchicum was probably known to the ancients; though some doubt is entertained whether it was the particular species now employed, or another of the same genus, which is referred to by their medical writers. But whatever may have been known of the remedy, it was entirely lost sight of until again brought before the notice of the profession by Störck of Vienna, who, in a treatise published in 1763, recommended it as a useful remedy in dropsy and other diseases. For a short time it enjoyed considerable reputation as a diuretic and expectorant; but had again passed into disuse, when the supposed discovery, that it was the active ingredient of the *eau médicinale d'Husson*, a secret remedy, famous in the cure of gout, once more revived its reputation, and gave it a place among our most valuable medicines, which it has ever since held, and is not likely soon to lose. This *eau médicinale* was prepared by a French military officer, named Husson, in the latter part of the last century, and proved so successful as an anti-arthritic remedy, that many attempts were made to discover its source and composition. It was soon found, as originally stated by M. Husson, to be of vegetable origin; and, so early as 1782, MM. Cadet and Parmentier announced that it was a vinous infusion. The claim was advanced, in favour of several plants, of being the chief ingredient, in consideration of similarity of effects; and, among them, of white hellebore and colchicum. Mr. Want, of London, put forth the claim of the latter medicine; and circumstances, independently of its effects, have given colour to the opinion of its identity with that celebrated nostrum. At all events, it has been found practically to answer the same purpose; so that we now no longer hear of the eau médicinale, except in its relations with the new remedy.

1. *Goût.* It seems to me impossible to doubt, that colchicum has peculiar efficacy in the treatment of gout. No one now claims for it the power of eradicating that disease, when firmly seated. In most instances, the diathesis forms an inherent part of the constitution derived from the parent. It is a modification stamped upon the original organic constituents of the frame, and we might as well attempt to eradicate a temperament, as to remove the gouty diathesis. But that the remedy has a powerful effect in moderating, and even controlling the gouty paroxysm, and other symptomatic demonstrations of the concealed disease, is proved, I think, beyond all reasonable controversy, by the almost united testimony of the practitioners who have employed it, and the host of sufferers who have experienced and daily experience its benefits. It has been said that any other medicine, or combination of medicines, acting equally on the stomach and bowels, and the various secretions, would prove equally effectual; but this statement is at once contradicted by the fact, that all other known medicines of similar powers, and almost all possible combinations of medicines, have been tried, and all abandoned for this one, which has now maintained its ground for more than thirty years. We might as well, it seems to me, deny the superior powers of opium as an anodyne and soporific, as to deny the peculiar efficacy of colchicum in gout.

At one time it was feared that, like the temporary expedients before and still occasionally used, it might afford present relief at the expense of future injury; that the paroxysm, though suppressed, would be likely to return sooner, and with greater severity, than if it had been left to its ordinary course; and that, in the end, life would be shortened. But experience has not confirmed these apprehensions. There are few, I presume, who look upon gout with the same fears as formerly. We have found a remedy which not only relieves the sufferings of the disease, but tends to prevent injury to the constitution, by obviating, in a considerable degree, the wear and tear of the paroxysms. It does not operate merely by removing the inflammatory symptoms, as bleeding, purging, and cold water will often do, but it removes them safely; because it modifies that very condition, which gives rise to the paroxysm. This is its peculiar excellence. It answers, in some degree, the purposes of the paroxysm itself, by removing for a time the morbid condition, which periodically and inevitably accumulates under the influence of the diathesis. The humoral physicians explain this result upon the supposition, that it causes the elimination from the blood of the

uric acid, or some other principle which they suppose to be the *materies morbi*, and the presence of which in the blood produces all the phenomena of the disease. But, considering the great frequency with which uric acid is thrown out from the system abundantly, and of course must have existed in the blood before being thrown out, without the existence of one peculiar gouty symptom, we are, I think, justified in concluding, that this acid is present in the blood in gout as in other diseases, simply as one of the incidents of the disease, and that its mere elimination from the blood has little to do with the cure. The probability is, that colchicum operates as an alterative in the relief of gout, changing the condition of the organic structure, possibly, as before suggested, by stimulating the disintegration of the tissues, and thus removing for a time the very substratum upon which the paroxysm rests. If it be true, as the observations of Chelius and Maclagan render probable, that colchicum produces an increase in the discharge of urea and uric acid, far beyond the normal amount, the fact would go far to show, that there is some basis for this view of its remedial influence.

It was at first supposed that, in order to suppress the gouty paroxysm, it was necessary to administer the colchicum largely, so as to produce active vomiting and purging, at least the latter; and certainly a more speedy effect is obtained in this way; but the united voice of experience is at present in favour of a more moderate use of the remedy, which is thus safer and less disagreeable, and in the end not less effectual. My own method of using it is, after the evacuation of the bowels, to administer twenty drops of the officinal wine of the root every four hours, until some evidence of its action is shown, either by nausea, disturbance of bowels, or increased secretion from the skin or kidneys; and then to sustain such an amount of these effects, as may consist perfectly with the comfort of the patient; considering them not as means of relief, so much as mere proofs that the medicine is acting. Should no obvious effects take place, the dose should be increased; if uncomfortable nausea or much purgation be produced, it should be reduced, or the medicine omitted for a time. It will often be found desirable to obviate its emetic and purgative tendencies, and give it a direction to the skin, by combining it with some preparation of opium, as the solution of sulphate of morphia. This is especially proper when the general state of the constitution is feeble, and the disease is disposed to the changeable or neuralgic forms. On the contrary, should the bowels be constipated, fever

exist, and the general state of the system be tolerably vigorous, it may be proper to combine the preparation of colchicum with a purgative, as magnesia, the sulphate of magnesia, or infusion of senna, or two or more of these together.

It is not only in the regular gouty paroxysm that colchicum is useful. It is probably not less efficacious in the various other morbid affections in which the diathesis occasionally explodes, whether inflammatory or nervous. The only contraindication is irritation of the stomach, and that sort of irritation which shows itself by nausea and vomiting; and even here the remedy may sometimes be used with advantage, in the form of enema with opiates.

Unfortunately, the influence of the remedy is sometimes impaired by the habit of using it; but it is still the most efficient to which recourse can be had; and the fact should serve to put us upon our guard against its early abuse. In chronic gout, it is less efficacious than in the acute form; but even here will often serve greatly to relieve the patient. It is advised, at present, by those most experienced in its use, not to omit the remedy with the first subsidence of the symptoms; but to go on with it, in gradually diminishing doses, until the paroxysm has wholly passed away, and indeed for some time afterwards.

2. *Rheumatism.* From the use of colchicum in gout to its use in rheumatism the transition was obvious; and many have found it scarcely less efficacious in the latter than in the former affection. I confess that my experience does not conform with theirs. In acute rheumatism, though I have used it considerably, I have been able to discover from it no greater effect than from any other medicine, which would equally affect the bowels and the secretions. I do not think I have ever seen it arrest at once, or materially shorten a case of the disease; and for some years I have almost abandoned its use. Nor is it much more effectual in fixed *chronic rheumatism.* But there are intermediate conditions of the disease, coming under the denomination of *subacute rheumatism*, sometimes seated in the muscles, sometimes in the joints, and often internal, and much disposed to change its position, in which the medicine has seemed to me to have been occasionally very useful, especially combined with morphia. The same remark is applicable to the *nervous* or *neuralgic forms.* Of course, the remedy is peculiarly applicable to those intermediate forms, seemingly in part gout and in part rheumatism, which are generally designated as *rheumatic gout*, or *gouty rheumatism.*

3. *Acute Cutaneous Eruptions.* In acute attacks of skin diseases, as lichen, prurigo, herpes, urticaria and other rashes, &c., colchicum may sometimes be used with advantage; and, when these affections occur in gouty individuals, should generally be added to other remedies, as they are often, under such circumstances, nothing more than one of the protean forms in which that disease shows itself. But even without this complication, the medicine may sometimes prove useful in these complaints, through its ordinary evacuant and eliminative properties.

4. *Fevers, and Inflammatory Diseases generally.* From its influence on the bowels and the secretions, but chiefly in consequence of a supposed direct depressing power over the circulation, colchicum has been recommended in these affections; but its tendency to disturb the stomach is a strong contraindication; and, as we are in possession of other more powerful and more easily managed antiphlogistic remedies, it is little employed. It is wholly inapplicable to typhoid cases.

5. *Dropsy.* This is the disease in which the medicine was originally used by Störck, and in which it was at one time thought to possess extraordinary powers. When it operates actively as a diuretic, it may certainly prove useful in the removal of dropsical effusions; but this effect cannot be relied on; and its disturbing influence on the stomach and bowels, when urged somewhat strongly, would render it frequently inappropriate. It is much inferior in efficacy to several other diuretics, and has no superior power, that I am aware of, to recommend it in this affection generally. When, however, as often happens, dropsy is associated with, or dependent on gouty disease, colchicum may with great propriety be administered in connexion with the more certain diuretics. It has been particularly recommended in dropsical collections in the pericardium and chest, connected with rheumatic or gouty cardiac disease.

6. *Asthma and Pectoral Diseases.* The possession of expectorant properties has recommended colchicum in cases of bronchial disease; and it has been thought specially useful in chronic bronchitis associated with asthmatic phenomena, as in the affection formerly denominated *humoral asthma.* Even in the paroxysm of spasmodic asthma it may sometimes prove useful. Irregular and nervous gout so often assumes the asthmatic character, that, independently of the influence which colchicum may exercise in this disease, through its nauseating and expectorant effects, it may often be found useful through its anti-arthritic virtues.

7. *Nervous Affections.* In *neuralgia*, colchicum is often very useful; because nothing is more common than gout and rheumatism lurking under that garb. The remedy has also been used, with asserted success, in *tetanus* idiopathic and traumatic, in *chorea*, *hypochondriasis*, *hysteria*, &c. Its powerful nauseating and depressing effects in large doses will no doubt often suppress nervous disorder, as the same influences from any other agent; but, except when these complaints may be associated with a gouty diathesis, there is no special call for this remedy.

Finally, colchicum has been employed against the *tape-worm*, and not without supposed success.

There is one great rule, in the application of this remedy, which will often be of practical advantage; namely, whenever no obvious contraindication to its use is presented, to have recourse to it, in persons suspected of a gouty diathesis, whenever any peculiar obstinacy in any affection whatever, not clearly incurable, may lead to the probable inference that gout may have something to do with its inveteracy. Thus, in a gentleman affected with a most obstinate chronic laryngitis and angina, which had resisted treatment for months, the disease yielded very speedily to a blue pill taken at bedtime, and a dose of wine of colchicum and magnesia in the morning. The mercurial, previously to this addition, had been of little or no obvious advantage.

3. *Administration.*

The dried cormus or seeds may be given in powder, in the dose of from two to eight grains every four, six, or eight hours, until the effects of the medicine are obtained, and gradually increased if necessary; but colchicum is at present almost never used in this form. The common forms of administration are the wines, tincture, or extract. I almost always employ preferably the *wine of the root;* because, being a saturated solution of the soluble matter of the cormus, it may, if properly prepared, be confidently relied on, so far as mere activity in the medicine is concerned. Should it be desirable, from any cause, to administer the remedy in the solid state, the officinal *acetous extract* may be used. The doses of these preparations are given below. The medicine is sometimes employed externally in the form of wine or tincture.

1. *Wine of Colchicum Root* (VINUM COLCHICI RADICIS, *U. S.*) is best prepared, according to the directions of the second formula of the U. S. Pharmacopœia. A preparation is secured by this process,

in which all the virtues that two pints of wine can extract from a pound of the dried cormus are contained. The wine is saturated, and consequently, though duly filtered, is apt to become turbid on exposure. The dose is from ten minims to a fluidrachm. The full medium dose, when it is desirable to avoid nausea, is about twenty minims; and some individuals cannot bear this quantity. A fluidrachm will often vomit. Two and a half fluidrachms are said to have proved fatal.

2. *Wine of Colchicum Seed* (VINUM COLCHICI SEMINIS, *U.S.*) is made in the proportion of four ounces of the seeds to two pints of sherry wine. This ought, if properly prepared, to be of equable strength, as the seeds keep well. The dose is from thirty minims to two fluidrachms. Two fluidounces have destroyed life.

3. *Tincture of Colchicum Seed* (TINCTURA COLCHICI SEMINIS, *U.S.*) is made in the same manner and proportions as the wine of the seeds, diluted alcohol being used as the menstruum. The objection to it, as an internal remedy, is the large proportion of spirit it contains. The dose is from thirty minims to two fluidrachms. It may be used externally, either alone or in combination with the camphorated tincture of soap, in gouty, rheumatic, syphilitic, and neuralgic pains.

4. *Compound Tincture of Colchicum* (TINCTURA COLCHICI COMPOSITA, *Lond.*) is a preparation of the London Pharmacopœia, differing from the preceding only in the use of aromatic spirit of ammonia as the menstruum. It is consequently more stimulant than the simple tincture, and is somewhat antacid; but these properties can scarcely be considered as advantages. It is little used.

5. *Vinegar of Colchicum* (ACETUM COLCHICI, *U.S.*) is an infusion of colchicum root in diluted acetic acid; the proportions being an ounce of the former to a pint of the latter. Vinegar or diluted acetic acid is an excellent solvent of the active matter of colchicum; and the preparation was at one time considerably used in dropsy. At present, however, it is little employed. The dose is from thirty minims to two fluidrachms.

6. *Acetic Extract of Colchicum* (EXTRACTUM COLCHICI ACETICUM, *U.S.*) is prepared by first treating the colchicum root with cold diluted acetic acid, and afterwards evaporating the acetous infusion. This is an excellent preparation, containing all the virtues of the root, and much prescribed when it is desired to exhibit colchicum in the form of pill. The dose is from one to three grains.

VII. SARSAPARILLA. *U.S., Dub.*

SARSA. *Lond.*—SARZA. *Ed.*

Origin. Sarsaparilla consists of the roots of different plants belonging to the genus Smilax. It was formerly referred to *Smilax Sarsaparilla*, which is indigenous in this country; but it is now believed that none of the commercial drug is obtained from that species. The particular plants which are known, or believed to furnish it, are *Smilax medica* growing in Mexico, and *S. syphilitica*, *S. officinalis*, and *S. papyracea*, which inhabit different parts of the northern section of South America, especially New Granada, Venezuela, and the northern provinces of Brazil. All these species are climbing, briery plants, having long slender roots, which proceed in all directions from a common rootstalk or rhizome.

Several varieties of sarsaparilla exist in commerce, distinguished by the names of the places of shipment, or the region whence they are derived: as the *Honduras*, *Vera Cruz* or *Tampico*, *Jamaica*, *Caracas*, *Brazil*, &c.; and some importance has been attached to these designations, as indicative of superior or inferior quality in the drug: but I believe that, in relation to the real value of sarsaparilla as a medicine, it is to be judged, not by the place of growth, or any distinctive exterior characters, but solely by the degree in which it possesses the peculiar taste of the medicine; so that the roots which have no taste whatever may be looked on as inert.

As sarsaparilla is usually imported, it consists either of whole roots, including rootstalk and radicals, folded lengthwise, or of the latter exclusively, separated from the rhizome, and in either case bound together, in large cylindrical bundles, by circular turns, either of the rootlets themselves, or of some flexible stem. In some, however, of the commercial varieties, the whole roots come separately; large numbers of them being loosely packed in bales.

Sensible Properties and Solubility. The rootstalk, when attached, is usually rejected. The proper roots are several feet in length, about as thick as a goose-quill on the average, flexible, generally wrinkled longitudinally, and of a grayish-brown or reddish-brown colour externally, and whitish or slightly reddish within. They consist of a central pith, a layer of ligneous fibre, and outside of this a cortical portion, covered with the coloured epidermis. From the tenacity of the woody layer, they can often be split for great portions of their length.

In its ordinary state, sarsaparilla has little or no smell; but it becomes distinctly odorous in decoction. Its taste is at first simply mucilaginous, or but very slightly bitter; but, if of good quality, it soon becomes, on being chewed, decidedly acrid, and leaves a durable and disagreeable sense of acrimony in the mouth and fauces. It imparts its virtues slowly to cold water, more rapidly to boiling water, and still more readily to diluted alcohol, which is the proper menstruum. Water, unless in very large quantity, seems to be incapable of exhausting the root; and by long boiling its virtues are sensibly impaired.

Chief Constituents. The active constituent of sarsaparilla is probably a principle first isolated by Dr. Palotta in 1824, and variously named. The proper title for it is *sarsaparillin;* but it has been called also *paraglin*, *smilacine*, *salseparine*, and *parillinic acid.* It is a white crystallizable substance, inodorous, of little taste in the solid state, but bitter, acrid, and nauseous in solution, very slightly soluble in cold water, more soluble in boiling water, and very soluble in alcohol, especially when heated. Ether and the volatile oils also dissolve it. Its aqueous solution, like the decoction of sarsaparilla itself, has the property of frothing very much when agitated. It is said to be volatilized at the temperature of a salt bath; and this fact accounts for the effect of decoction in impairing the virtues of the root. For the mode of preparing *sarsaparillin*, see the U.S. Dispensatory. It has been given internally, and found to be borne well by the stomach in the dose of six grains. Nine grains caused nausea, and a feeling of weight in the epigastrium. According to Dr. Palotta, in doses of from two to thirteen grains, it occasions a sense of constriction in the throat, nausea, and diaphoresis, and depresses the circulation.

Besides sarsaparillin, the root contains a minute proportion of *volatile oil*, some *resin* and *extractive*, and a large proportion of *starch.* With this last principle its medicinal activity was at one time thought to be associated; and hence originated the long boiling to which it was formerly subjected, and which is still retained by some of the British authorities. The starch is wholly inert, and the long boiling only injurious.

Effects on the System. In the ordinary medicinal doses, sarsaparilla produces little sensible effect. It is thought, and probably with justice, moderately to promote perspiration and the secretion of urine. In this respect, it resembles most other acrid substances which enter the circulation. The system is intolerant of their pre-

sence; and hence the eliminating functions are made specially susceptible to their excitant influence. Sarsaparilla, however, is almost always administered with a large quantity of liquid; and it is not easy to determine how much of the effect on the secretions is to be ascribed to the medicine, and how much to the vehicle. In larger doses, it produces feelings of gastric oppression, nausea, and sometimes vomiting. Its sensible effects, however, are not sufficient to explain the therapeutic advantages ascribed to it; and they who claim for it extraordinary value as a medicine, must refer its curative effects to an alterative influence. Like the other alteratives already considered, it may have the property of stimulating the normal functions of disintegration and repair into increased activity, thereby removing gradually the substratum of the morbid action, and the disease along with it.

Therapeutic Application. Few medicines have suffered such vicissitudes of popularity as sarsaparilla; at one time being in high repute, at another almost entirely neglected, then again revived, to be again depressed; but at no time commanding a unanimous opinion in its favour. Introduced about the year 1530 into Europe, from the Spanish West Indies, where it enjoyed much repute as an anti-syphilitic remedy, it came into considerable vogue; but seems to have afterwards been almost lost sight of until again brought into notice, about the middle of the seventeenth century, by Sir William Fordyce, who recommended it strongly as an adjuvant and corrective of mercury, in the treatment of the venereal disease. Cullen's unfavourable opinion had probably no little influence in setting the current of professional sentiment once more against it; and, at the commencement of the present century, and for some time afterwards, it seems to have been much neglected. Empirics, however, now took possession of the abandoned remedy; and the success they met with, either from the efficacy of the sarsaparilla itself, or of the secret additions they made to it, was striking enough once more to attract the notice of the regular profession, by whom the medicine was again received into a favour, which it has not subsequently lost. It seems to me impossible to resist the conclusion, which this short history suggests, that a remedy cannot be quite inert, which has so often risen into notice after neglect, and which, though considered useless by many, has the voice of the greater number, and those probably the most experienced, in its favour. One cause, probably, of the unfavourable opinion has been the ignorance of what gives real efficacy to the medicine, and the

consequent vicious methods of pharmaceutical treatment to which it has been subjected. It is not strange that practitioners have been often disappointed, when they estimated a specimen of the root, not by its acrimony, but by the proportion of starch it contained, and, in order to extract this inert starch for use, tortured the medicine with an amount of boiling, sufficient almost wholly to drive off or destroy the proper active principle.

Secondary syphilis is the affection in the treatment of which sarsaparilla has always enjoyed the highest reputation. It is on all hands admitted to be inadequate to the cure of the primary disease; and there are probably few who would venture to trust the secondary symptoms to sarsaparilla alone. But, associated with mercury, it seems to have produced effects which could not always be obtained from that medicine unaided; and it is thought very often to have corrected that cachectic state of system, or depraved health, which has remained in syphilitic cases after the use of mercury, and which it has been customary to ascribe to that medicine; as we daily see, in miasmatic regions, the shattered health produced and left behind by intermittent and remittent fevers, ascribed to the quinia by which the febrile paroxysms had been subdued. The curative effect of sarsaparilla is very slow, because the alterative change of tissue upon which its efficacy probably depends, is also slow; and this very slowness may constitute one of its real merits; as it seems difficult seriously to abuse a remedy of such feeble physiological action. But gradually, under its use, the appetite often increases, the general nutrition improves, the secretions assume their normal state, and the morbid phenomena disappear, one after another, till finally health is restored. A new and healthy tissue has taken the place of the old and diseased.

Chronic rheumatism, *various forms of scrofulous disease*, and *chronic cutaneous eruptions*, are the other complaints in which sarsaparilla has been used with supposed advantage; and, in any case of general cachexia, or depraved condition of health, which can be traced to no special cause, and for which there is no known special remedy or set of remedies, this medicine may be appropriately used, in connexion with others which may seem to offer some hope of benefit.

Administration. The powder of sarsaparilla may be given in the dose of from thirty grains to a drachm, three or four times daily, to be gradually increased until a slight effect on the stomach is experienced, and then somewhat diminished so as to be kept within

the nauseating point. One drachm of the most efficacious parcels will sometimes produce nausea. But this is not an eligible form for administering the medicine, in consequence of the large proportion of useless matter. The following are the several officinal preparations used.

The *Simple Infusion* (INFUSUM SARSAPARILLÆ, *U. S.*) is prepared by digesting an ounce of the bruised root in a pint of boiling water for two hours; or, preferably, by the process of percolation, the same proportions being used. This is probably as efficient a preparation as can be made of sarsaparilla alone, by means of water as the menstruum. But, as water is incapable of taking up all the virtues of the root, unless used in very large proportion, the preparation is not a very strong one. The dose of it is three or four fluidounces, three times a day.

A *simple decoction* may be prepared by macerating two ounces of the bruised root in a quart of water for an hour, then boiling for ten or fifteen minutes in a covered vessel, and straining the liquid. This is essentially the decoction of the Dublin Pharmacopœia, and, in reference to its strength, may be considered as identical with the U. S. infusion. The London and Edinburgh decoctions are made by long boiling, which is not in accordance with the views at present received of the proper treatment of sarsaparilla.

The *Compound Decoction of Sarsaparilla* (DECOCTUM SARSAPARILLÆ COMPOSITUM, *U. S.*) is made, according to the U. S. Pharmacopœia, by macerating six ounces of bruised sarsaparilla, an ounce, each, of bark of sassafras root sliced, guaiacum wood rasped, and liquorice root bruised, and three drachms of mezereon, in four pints of water, for twelve hours; then boiling for fifteen minutes, and straining. This is an imitation of a preparation formerly in great repute, under the name of *Lisbon diet drink*, and is one of the best forms in which sarsaparilla can be prescribed. Guaiacum wood yields very little of its virtues to water; liquorice root merely serves by its demulcent properties to obtund somewhat the acrimony of the other ingredients, and the sassafras bark serves little other purposes than to impart flavour; so that the efficiency of the decoction depends mainly on the sarsaparilla and mezereon. The dose is about four fluidounces three or four times a day.

The *Compound Syrup of Sarsaparilla* (SYRUPUS SARSAPARILLÆ COMPOSITUS, *U. S.*) is made by first forming a tincture, with diluted alcohol, of sarsaparilla, guaiacum wood, roses, senna, and liquorice root, then evaporating off most of the alcohol, and incorporating sufficient sugar with the residue to form a syrup, which is

flavoured with a minute quantity of the volatile oils of sassafras, anise, and partridge-berry. This syrup was prepared in imitation of the famous *sirop de Cuisinier*, and differs from the decoction mainly in the omission of mezereon, and the introduction of senna, which renders it slightly laxative. It is very much used, and perhaps the most popular preparation of sarsaparilla employed in this country. It is an entirely different preparation from the syrup of the British Colleges, in which sarsaparilla is the only active ingredient, and that probably rendered inert, or nearly so, by the long boiling. The dose of the compound syrup is half a fluidounce, three or four times a day.

The *Extract of Sarsaparilla* (EXTRACTUM SARSAPARILLÆ, *U. S.*) is made, according to our officinal code, by first forming a tincture of sarsaparilla with diluted alcohol, by means of percolation, then distilling off the alcohol, and evaporating the residue to a proper consistence. The diluted alcohol thoroughly exhausts the root of its active matter, while it leaves the inert starch; and the heat necessary for the concentration of the preparation, if properly regulated, is not sufficient to drive off or decompose the sarsaparillin. The extract may, therefore, be considered as having all the virtues of the sarsaparilla in a concentrated state, and is an excellent preparation. The dose is from ten to twenty grains three or four times a day.

The *Fluid Extract of Sarsaparilla* (EXTRACTUM SARSAPARILLÆ FLUIDUM, *U. S.*) is a compound preparation, in making which, all the ingredients of the compound decoction, except the guaiacum, are treated with diluted alcohol so as to form a tincture, which is afterwards very much reduced by evaporation, and then incorporated with enough sugar to enable it to keep. This is an excellent preparation, and may be considered as representing the compound decoction in a very concentrated state. The dose is a fluidrachm, equivalent to a drachm of the root.

VIII. GUAIACUM.

GUAIACUM WOOD.—GUAIACI LIGNUM. *U. S., Lond., Ed.*

GUAIAC.—GUAIACI RESINA. *U. S.*—GUAIACUM. *Lond., Ed., Dub.*

Origin. There are two products of *Guaiacum officinale*, a large tree growing in the West Indies, which are employed in medicine;

namely, the wood, and a resinous substance obtained in various methods from the trunk. It is to the latter that the name of guaiac, as officinally used in this country, properly belongs.

1. GUAIACUM WOOD (*Guaiaci Lignum*), often called *lignum vitæ*, is usually imported in billets, with the bark attached. It is hard, compact, and heavy, with the central or heart-wood of a brownish-green colour, and the outer portion or sap-wood, yellow. In the shops it is usually kept in the state of shavings or raspings, which have the two colours mixed. Inodorous under ordinary circumstances, it acquires a distinct and somewhat fragrant smell, when rubbed or heated. Its taste is slight at first, but becomes feebly acrid when it is chewed. It yields its virtues partially to water, and completely to alcohol. These depend on an *extractive matter* and *resin*, the former of which is somewhat acrid, and is the only active part which water extracts from the wood.

2. GUAIAC (*Guaiaci Resina*), or *guaiacum resin*, is obtained in three different methods. 1. It sometimes exudes in the form of a liquid juice from the tree, either spontaneously or through wounds in the bark, and concretes on exposure. 2. Another method of obtaining it is to bore a hole, by means of an auger, longitudinally into one end of a log or billet of the wood, and to put the other end into a fire. The resinous matter contained in it melts with the heat, and, running out through the auger hole, is received in vessels, in which it hardens. 3. The third, and, I presume, the most common method, is to boil the chips, sawdust, and pieces of bark, in water, holding common salt in solution, and to skim off the melted resin as it rises to the surface. Procured in this manner, it is in irregular masses, which are obviously full of impurities, such as small fragments of bark, &c., from which it may be freed by melting and straining.

Sensible and Chemical Properties.—As guaiac is kept in the shops, it is usually in irregular lumps, of a greenish-brown or dark-olive colour on the outside, and, when broken, exhibiting a smooth, shining, conchoidal surface, which is at first reddish-brown, but assumes a green tint on exposure. The edges of the broken pieces are translucent. The powder is of a light gray colour, changing to green with time, and is apt to cohere into a mass, which ultimately becomes compact and hard, in consequence, probably, of a partial fusion in hot weather. The odour is feeble, but agreeable, and increased by heat. The taste is at first scarcely perceptible, but after a time becomes sensibly acrid, and persists long. Guaiac

softens in the mouth, melts at a low temperature, and is inflammable. It yields about nine per cent. of its weight to water, and is wholly dissolved, with the exception of impurities, by alcohol. It is also soluble in ether and alkaline solutions. The alcoholic solution is of a dark-brown colour, deposits resin on the addition of water, and imparts a blue colour to milk, gluten and vegetable products containing it, mucilage of gum arabic, &c. The change to green which guaiac undergoes on exposure, is thought to be owing to the absorption of oxygen. It consists of 9 parts of extractive matter, and 91 of resin, in 100 parts. The resin has peculiarities which distinguish it from other resinous substances, and has received the name of *guaiacin*. It has the acid property of uniting with alkalies to form soluble compounds, and, in view of this property, is sometimes called *guaiacic acid*. The mineral acids are incompatible with guaiac.

Effects of the Wood and Resin on the System. As the wood owes all its virtues to the guaiac contained in it, the effects of the two are identical, only that the wood is feebler. The ordinary remedial doses produce little observable effect. When the quantity taken is sufficiently large to make itself decidedly felt, there is a sense of warmth in the stomach, followed by slight anorexia, with dryness of the mouth, thirst, and often a moderate general excitement, indicated by some increase in the frequency of pulse and heat of skin. There is also a tendency to increased secretion, especially from the skin or kidneys; one or the other direction being taken, according to attendant circumstances. If the patient is kept warm in bed, and the powder of ipecacuanha and opium, or the antimonials, with warm drinks, are at the same time exhibited, profuse perspiration is often induced, probably more copious than it would be without the guaiac. If, on the contrary, the patient is walking about, and takes cold drinks, the medicine is more apt to act as a diuretic. In large doses it frequently operates on the bowels. It is thought also by some to stimulate the menstrual flux, and occasionally seems to act as a sialagogue. Like other substances acting as irritants to the stomach and bowels, it sometimes occasions an eruption upon the skin. In great excess, it produces nausea, vomiting, purging, and febrile symptoms.

From its occasional effects in increasing perspiration, it has usually been ranked among the stimulating diaphoretics; but this effect is neither so considerable nor certain as to serve as a sufficient basis for classification.

Like sarsaparilla and some other acrid substances, guaiac appears to operate as an alterative, and, through this agency, to produce whatever curative effects are obtained from its use. It probably enters the circulation, and there excites the different emunctories, and at the same time the whole ultimate organic structure, including the capillaries; modifying their condition favourably in some cases of disease.

Therapeutic Application. The virtues of the *wood* are said to have been known to the aborigines, from whom the Spaniards derived the medicine. It was taken to Europe so early as 1508, and acquired great reputation in the treatment of syphilis, which gave origin to the name of wood of life (*lignum vitæ*), by which it has ever since been distinguished. But its powers were greatly exaggerated; and at present it is considered as a mere accessary to other measures, and of very doubtful efficiency even in this capacity. It is almost never used, except in connexion with sarsaparilla, in the compound decoction and compound syrup of that root. The Edinburgh College still give directions for a *Decoction* (DECOCTUM GUAIACI, *Ed.*), prepared by boiling guaiac wood, raisins, sassafras root, and liquorice root in water. It is the old *decoction of the woods*, formerly in much repute as an adjuvant to an alterative course of mercurials or antimonials, in syphilis, chronic rheumatism, cutaneous affections, &c., but now very seldom used.

The *resin* is more active, and has considerable reputation in the treatment of rheumatism and some other diseases.

In *acute rheumatism*, it appears to be sometimes useful at that period of the disease, when the time for depletion is passed, and moderate stimulation is not inadmissible. Under these circumstances, it may be given combined with opium and ipecacuanha, nitre, calomel, or the antimonials, one or more, in the dose of ten or fifteen grains every two hours. It is, however, probably better adapted to the *subacute* or *neuralgic* cases, and especially the *chronic*, in which it is much employed, either in the form of powder, or of tincture, which is generally preferred.

It is also used occasionally in cases of *chronic* and *irregular* or *nervous gout*, especially when a stimulant is required.

In *amenorrhœa* and *dysmenorrhœa*, it was a favourite remedy with the late Professor Dewees, of Philadelphia; and, as the latter of these affections is probably often nothing more than disguised rheumatism, its usefulness is readily intelligible. I have myself used it in

some cases with apparent success; that is, the patients recovered under its use.

Secondary syphilis, chronic cutaneous diseases, different forms of scrofula, and *indefinite cachectic states of system* without special name, have been treated with guaiacum; but always in combination with other remedies. Thus, it is one of the ingredients in the *Compound Calomel Pills* (PILULÆ CALOMELANOS COMPOSITÆ, *Ed.*, *Dub.*), or *Plummer's pills*, as they are commonly called, in which it is associated with calomel and precipitated sulphuret of antimony, and which are occasionally prescribed in the complaints above mentioned. (See *page* 294.)

Administration. Guaiac is given in substance, or tincture. The dose of the resin is from ten to thirty grains, which may be exhibited in pill, or in powder suspended in water rendered viscid by sugar and gum arabic, or in milk. With water alone it will not mix. It may be made into the form of *Mixture* (MISTURA GUAIACI, *Lond.*), by rubbing together a drachm and a half of the powder, two drachms of sugar, and a drachm of powdered gum arabic, and adding, during the trituration, ten fluidounces of a mixture of equal parts of pure water and the U. S. cinnamon water. The dose of this mixture would be one or two fluidounces.

There are two tinctures, the simple and ammoniated.

The *Simple Tincture* (TINCTURA GUAIACI, *U. S.*), is merely a solution of guaiac in alcohol, and is given in the dose of a fluidrachm three times a day, increased if necessary.

The *Ammoniated Tincture* (TINCTURA GUAIACI AMMONIATA, *U. S.*) is prepared with aromatic spirit of ammonia, instead of alcohol, and differs from the preceding in being more stimulant, and at the same time somewhat antacid. The dose is the same.

Both tinctures are decomposed by water; and the resin thrown down refuses to mix with that fluid, so that it is advisable to administer the tincture in sweetened water, thin mucilage, or milk.

IX. MEZEREON.

MEZEREUM. *U. S.*, *Lond.*—MEZEREON. *Ed.*, *Dub.*

Origin. As directed by our officinal code, and as found in the shops of this country, mezereon is the bark of two species of Daphne, namely, *D. Mezereum*, and *D. Gnidium*, both small shrubs, growing in Europe, the former abundantly in Great Britain, the latter in

the Southern parts of the Continent. The bark both of the stem and root is efficient; but it is that of the stem which is most common in our markets.

Sensible Properties and Solubility. The bark is in strips, often several feet in length, about an inch in breadth where broadest, and gradually tapering towards one or both ends. It is covered externally with a grayish or reddish brown, easily separable epidermis, is whitish on the inner surface, very tough and flexible, and comes to us either folded in bundles, or wrapped in balls. In the recent state, it has a nauseous smell, and an extremely acrid taste; when dried, it is nearly inodorous, but retains much of its acrid taste, which is preceded by a sense of sweetness. It yields its virtues to water and alcohol.

Active Principles. Mezereon contains a peculiar crystallizable principle, of a bitter, rough taste, called *daphnin*, and an *acrid resinoid substance*, slightly soluble in water, upon which the irritant properties of the bark depend. It contains also a volatile acrid principle, probably a volatile oil, which is most abundant in the fresh bark, but either escapes, or, as suspected by Vauquelin, is changed into the acrid resin by time. When mezereon is boiled with water, an acrid principle, according to Mr. Squire, escapes with the vapour; but it is not given off when the bark is boiled in alcohol, probably because the temperature is not sufficiently high.

Effects on the System. Mezereon is a powerful local irritant, in its recent state inflaming and vesicating the surface, and, even when dried, producing the same effect, though much more slowly. When swallowed, therefore, it is capable of severely irritating the stomach, and may even prove poisonous by the violence of its local action.

In such doses as not to disturb the stomach, it is supposed to stimulate the secretions, particularly those of the skin and kidneys; and somewhat more largely given, produces purging, nausea, vomiting, and other signs of gastro-intestinal irritation or inflammation. It is said sometimes to irritate the urinary passages like cantharides; and this can be readily understood, if it be admitted that its acrid principle enters the circulation, and escapes by the kidneys. Though no fatal case of poisoning from the bark, so far as I know, is recorded, alarming symptoms have in several instances followed the eating of the fruit, which probably owes it properties to the same acrid principle; and one fatal case at least has occurred in a child. The usual symptoms have been violent vomiting and purging, with severe abdominal pains, and great prostration. In a few

instances, cerebral symptoms are reported to have occurred, as drowsiness, giddiness, imperfect vision and dilated pupils, and, in one instance, an approach to insensibility; but the phenomena are not, I think, sufficiently decisive to justify the inference that the medicine possesses narcotic powers; for nothing is more common than the occurrence of cerebral disorder, as a result of great gastric disturbance. (See *Am. Journ. of Med. Sci.*, xxi. 518.)

Therapeutic Application. Of the use of mezereon as a local irritant there will be occasion to speak hereafter. As an alterative it has long been employed in secondary syphilis, chronic rheumatism, scrofulous affections, and chronic cutaneous eruptions. At one time it enjoyed considerable reputation; but at present, little confidence is felt in its curative powers in these or any other complaints; and it is seldom used internally, except as an ingredient of the compound decoction and fluid extract of sarsaparilla. The dose of the bark in powder would be about ten grains; but it is never used in this form. The Edinburgh College retains a *Decoction* (DECOCTUM MEZEREI, *Ed.*), made with two drachms of the bark, and half an ounce of liquorice, to two imperial pints (two pints and a half in our measure) of water, boiled down to one-half. The dose is from four to eight fluidounces three or four times a day.

X. BARK OF SASSAFRAS ROOT.

SASSAFRAS RADICIS CORTEX. *U. S.*

Origin. This is the product of *Sassafras officinale* (Nees), *Laurus Sassafras* (Linn.), a tree of medium size, growing in all parts of the United States, and said to extend also into Mexico. The U. S. Pharmacopœia directs the bark of the root, which is the part always kept in our shops; the British Pharmacopœias direct the whole root. As the wood constitutes a large part of the root, and possesses very little medicinal virtue, it is evident that our national standard is correct in excluding it.

Sensible Properties and Solubility. The bark, as kept in the shops, is in rather small, irregular fragments, sometimes with, sometimes without epidermis, light, spongy, brittle, of a reddish-brown colour, inclining to that of cinnamon, lighter on the broken surface, of a fragrant odour, and a sweetish, somewhat pungent, aromatic taste. These properties it yields moderately to water, and much more freely to alcohol.

Active Principle. The virtues of sassafras depend exclusively on a *Volatile Oil* (OLEUM SASSAFRAS, *U. S.*), which is obtained separate by distillation with water. It is of a yellow colour, becoming reddish with age, somewhat heavier than water, and possessed in a high degree of the sensible properties of the bark.

Effects on the System. I have placed sassafras bark among the alteratives, not so much on account of its real properties, as from the circumstance, that it is almost exclusively used in association with sarsaparilla, guaiacum wood, &c. In its effects on the system, it is more closely allied to the aromatics than to any other medicines, being an agreeable stomachic stimulant and carminative. Its oil, however, appears to find a readier entrance into the circulation than most of the other aromatic oils, and, therefore, to act more decidedly on the system at large, which it gently stimulates. The bark taken in warm infusion, with a large proportion of water, while it moderately excites the circulation, sometimes increases perspiration; and hence is generally placed among the stimulating diaphoretics.

Therapeutic Application. A tea made of the bark of sassafras root has long been employed in this country as an agreeable beverage, and under the notion also that it purified the blood. It was probably adopted by the profession from popular usage, and formerly had considerable reputation in secondary syphilis and syphiloid affections, cutaneous eruptions, and chronic rheumatism. At present, however, it is employed almost exclusively as an adjuvant to sarsaparilla, guaiacum, and mezereon, in the compound preparations of those alteratives, in which, if it answers no other useful purpose, it at least proves serviceable by its agreeable flavour. I am inclined, however, to the opinion that, though feeble, it has alterative properties in a slight degree; as a persevering popular usage of any remedy is generally based upon an experience of its effects; and medicines which, in the caprice of professional action, have been abandoned and readopted, have sometimes retained, in the mean time, a firm hold upon the favourable opinion of the multitude.

The bark of sassafras root, or the root itself, is an ingredient in the *compound decoction* and *fluid extract of sarsaparilla*, and the *decoction of guaiacum wood;* and the oil is used to flavour the *compound syrup of sarsaparilla.* An infusion of the bark may be made in the proportion of half an ounce to a pint of water, and used *ad libitum.* The oil may be given as a gastric stimulant or carminative in the dose of from two to ten drops.

XI. BITTERSWEET.

DULCAMARA. *U.S., Lond., Ed., Dub.*

Dulcamara consists of the twigs or stems of *Solanum Dulcamara*, or *woody night-shade*, a half-climbing shrub, indigenous in the United States, and growing wild also in Europe. From its botanical relations, this medicine should be associated with the cerebral stimulants, as it is one of the same family, the *Solanaceæ*, to which belladonna, stramonium, and hyoscyamus belong. It is also said to contain solania, an organic alkali, which certainly has narcotic properties. But, though I have used dulcamara often and freely, I have never witnessed any symptoms from it which would entitle it to be considered as a narcotic; and, as the almost exclusive use of it, at present made, is as an alterative in cutaneous diseases, it would seem to belong more properly to the class of medicines with which it is here associated.

Sensible Properties and Solubility. As kept in the shops, the dried twigs are cylindrical, about as thick as a goose-quill, wrinkled longitudinally, and of a grayish-ash colour externally. When cut across, they are found to consist of a cortical and ligneous portion, and a central pith. Though of a rather nauseous odour when fresh and bruised, they are inodorous when dry. Their taste, when they are chewed, is at first bitter and afterwards sweetish; properties which are expressed both in their English and Latin names. They are also slightly acrid. They yield their virtues to boiling water.

Active Principles. Besides the alkaloid *solania*, they contain a peculiar principle called *picroglycion*, or *dulcamarin*, which has a sweet and bitter taste, and is probably the source of these properties in the stems. But neither of these principles has been isolated for medical use.

Effects on the System. Dulcamara is thought to be feebly narcotic, and to have the property of increasing the secretions of the skin and kidneys. Considering the amount of liquid usually taken along with it, these latter effects might be expected; but I am not disposed to deny its influence on the secretions, though it is certainly not very obvious. The only physiological effect which I have witnessed from it, taken in the quantity of a pint of the decoction daily, has been retardation of the capillary circulation, with perhaps some weakness of the pulse. I have never known it to produce cerebral disturbance; and, in any ordinary dose, it is

certainly not entitled to be considered as a narcotic. In very large quantities, it is said to produce nausea, vomiting, faintness, vertigo, some convulsive motions, and slight paralytic phenomena, without any loss of consciousness. Antaphrodisiac properties have also been ascribed to it.

Therapeutic Application. This remedy has at different times enjoyed some reputation in the treatment of chronic rheumatism and catarrh, and of the various cachexiæ for which the other vegetable alteratives are employed. At present, however, it is confined almost exclusively to chronic cutaneous diseases, in which it is supposed to act as an alterative. It appears to me to operate as a direct sedative to the capillary circulation, and may possibly prove useful in that way. It is almost always given in connexion with other more powerful alteratives, such as arsenic and the antimonials. I employ it habitually in chronic *psoriasis*, *lepra*, *pityriasis*, and in the advanced stage of *eczema* and *impetigo;* and should consider it appropriate to chronic *lichenous* affections. But, as I almost always prescribe one of the mineral alteratives at the same time, I find it difficult to determine how much of the cure is owing to the mineral, and how much to the vegetable remedy. Nevertheless, I think I have seen it, without aid, check at least the tendency of these affections to increase, and modify the constitutional condition on which they depend. It is also sometimes administered as an antaphrodisiac, and one or two cases have occurred to me, in which it seemed to act beneficially in this way.

Administration. Dulcamara is usually given in decoction. The officinal *Decoction* (DECOCTUM DULCAMARÆ, *U. S.*) is made by boiling an ounce of the bruised twigs in a pint and a half of water to a pint. The dose is a wineglassful three or four times a day. I have sometimes, in skin affections, given twice this quantity daily.

A *Watery Extract* (EXTRACTUM DULCAMARÆ, *U. S.*) is also directed by the U. S. Pharmacopœia, the dose of which is from five to ten grains, but of which a larger quantity may be given with impunity.

Subdivision 2.

LOCAL REMEDIES.

CHAPTER I.

Local Remedies Affecting the Functions.

CLASS I.

EMETICS.

EMETICS are medicines which cause vomiting, in certain doses, as an ordinary result, and in the healthy state of the stomach. A large quantity of almost any liquid may provoke vomiting by over-distension of the stomach. The nauseous taste of certain substances, or offensive associations in relation to them in the mind of the patient, or the idiosyncrasy of particular individuals, may occasionally lead to the same result from medicines which ordinarily have no such effect. Lastly, in an irritated state of the stomach, almost anything introduced into it will give rise to vomiting, sometimes even a teaspoonful of water. Substances, however, acting in these several methods, are not considered as emetics; and it is thus obvious, that each of the conditions mentioned in the definition is essential.

1. *Operation of Emetics.*

Symptoms. The vomiting does not immediately follow the administration of the emetic. At first, no unusual sensation is experienced, except that which may be occasioned by the disagreeable taste of the medicine. But, in a period varying from five to thirty minutes, an uneasiness is usually experienced in the epigastrium, soon followed by the sensation denominated nausea, with a peculiar attendant state of system; vermicular motions are not unfrequently felt in the stomach; and these phenomena increase in intensity until vomiting, at length, takes place. Sometimes the

stomach discharges its contents at one effort: but more frequently the emetic action is repeated, and occasionally several times, before the organ becomes quiescent.

From the commencement of the feeling of nausea, to the return of the system to its original condition, a series of phenomena occur, which it is very necessary to understand, in order to appreciate the full therapeutic influence of emetics. During the nausea, the face is pale; the skin cool, moist, and relaxed; the pulse feeble, frequent, and often irregular; the saliva flows copiously; and feelings are usually experienced of gastric uneasiness, languor, and universal weakness, which are sometimes in the highest degree distressing, so much so as, if long continued, to render the patient utterly prostrate in mind and body, and indifferent to all things around him, even to life itself. It is very seldom, however, that the nauseating influence is felt in this degree; and sometimes it is scarcely experienced at all; vomiting coming on promptly, and with little antecedent sensation of any kind. Emetics differ extremely in the degree to which they produce nausea. Thus, the sulphates of copper and zinc cause very little; tobacco and lobelia, a great deal, and often prolonged.

During the act of vomiting, another set of symptoms appear. Instead of the sensation of nausea, there is a feeling of constriction in the epigastrium, not unfrequently amounting to spasmodic pain. The face is flushed, the jugular veins are swollen, the temples feel as if distended, there is a general sense of fulness of the head, and sometimes pain, the pulse becomes full and often slow; there is obvious congestion of the brain, resulting from an impeded return of blood from the head. A copious sweat often breaks out, particularly about the face, neck, and upper part of the body. Occasionally, though rarely, an involuntary discharge takes place of the contents of the bladder or rectum. The matter vomited varies, being at first the previous contents of the stomach; but afterwards, if the act be repeated, different liquid secretions, mucus, pancreatic liquor, or bile; and sometimes there is a slight intermixture of blood, derived probably from the rupture of a small vessel in the pharynx or œsophagus, caused by its over-distension.

Upon the subsidence of the vomiting, the system falls again into a state of general relaxation, but not, in this stage, attended with nausea. The depression now existing is a result of the immediately antecedent state of violent muscular action. The skin is moist, and relaxed; the pulse, soft and rather feeble; and feel-

ings of languor and weakness are experienced, which often end in drowsiness, or even sound sleep. The drowsiness is so obvious a phenomenon, that, in experiments upon lower animals, substances which have produced an emetic effect, have sometimes been erroneously considered as having narcotic properties, in consequence of the apparent stupor which has followed vomiting. It is nothing more than the rest of the brain, after the commotion into which it has been thrown.

Not unfrequently, after the system has suffered a short continuance of depression, it reacts again; and something like gentle febrile phenomena are produced; but, in most instances, there is a gradual return to the former state, with whatever difference, in regard to any previously abnormal condition, the action of the emetic may have occasioned.

Unpleasant and even dangerous results sometimes attend or follow the emetic action. The great distension of the blood-vessels of the brain, has caused apoplectic phenomena, probably from effusion of blood. I have never witnessed an instance of this kind; but my preceptor, the late Dr. Parrish, used to relate to his pupils the case of a young man under his care, who, in the act of vomiting, was attacked with apoplexy, which proved fatal. The pulmonary congestion has led also occasionally to bleeding from the lungs; and the uterus is said to have suffered in the same way. Hernia, rupture of the abdominal walls, rupture of the stomach itself, prolapsus uteri, and abortion, are other evil effects which have sometimes been ascribed to the straining produced by emetics. The prostration in which the system is thrown by the nausea, or is left after the violence of the muscular action, is sometimes alarming, and has proved fatal in some cases of great previous debility. Another source of danger has been pointed out. In the stasis of blood attendant on the extreme circulatory prostration of the state of protracted nausea, or secondary depression, amounting sometimes almost or quite to syncope, it is asserted that coagulation of the fibrin has taken place in the heart or elsewhere; and the clots being carried into the arteries have arrested circulation, and given rise to mortification of remote parts. Thus, cases are recorded in which gangrene of the feet, hands, and even of the nose and ears, has followed the prolonged prostration or partial syncope of vomiting. But cases of the kind above mentioned are very rare. I must confess that I cannot recall an instance of serious injury having occurred from the operation of an emetic, under my own personal observation.

Mechanism of Vomiting. Different opinions have been held as to the precise agency concerned in the act of vomiting. Some have maintained that it is effected exclusively by the contraction of the stomach; others, that this organ is entirely passive, and that the diaphragm and abdominal muscles alone are concerned; others, again, that both act conjointly; and the last opinion is the one, I believe, now generally adopted. That the abdominal muscles and the diaphragm contract in the effort, is obvious to every one acquainted with the anatomy of the parts, who has ever vomited himself, or seen another vomit. As to the stomach, it has been seen to contract at the moment its contents were discharged; and I am quite confident that I have felt it, in my own person, spasmodically contracting under the influence of an emetic. The combination of actions seems to be as follows; all occurring simultaneously. The rima glottidis is closed, so as to prevent expiration; the cardiac orifice relaxes, so as to permit the upward passage of liquids from the stomach; the pylorus contracts, and thus obstructs the passage downward; and, the diaphragm descending, and the abdominal muscles pressing inwards, while the stomach itself contracts correspondingly, it necessarily follows that the contents of the stomach are driven upwards, as in this direction is the only outlet. It is true that bile is sometimes thrown up, and even the contents of the small intestines, in certain rare instances; but in these cases, the constriction which prevents the downward movement of the liquids, instead of being at the pylorus, is in the small intestine, at some point below that from which the inverted movement takes place. The closure of the glottis is necessary; as otherwise the contraction of the abdominal muscles would be in part expended in the expulsion of the air from the lungs, and the stomach would feel little of the pressure. There is no occasion for the intervention of an inverted peristaltic movement, which some have imagined. The result is explicable in accordance with the most obvious physical laws. A cavity whose capacity is variable is compressed; and its liquid contents escape through the only existing outlet.

Effective Cause of Vomiting. The muscular movements above explained are the mere mechanical agency by which vomiting is produced. The influence which calls the muscles into joint action is the real and effective cause. This cannot be the simple impression of the emetic upon the gastric mucous membrane; for, though

such an impression might excite the peristaltic movement of the stomach by a direct transmission to its muscular coat, the movement would not produce vomiting. The cardia being closed, if any effect were produced, it would be to expel the contents of the stomach downward. It could not possibly call into harmonious co-operation all the agencies concerned in vomiting. The impression, therefore, must be conveyed to some common centre, capable of uniting and harmonizing all these movements. This centre is in the nervous system. It is probably in the medulla oblongata, and the neighbouring parts of the encephalon. It will be remembered that the expelling movements are not the whole of the phenomena. These are preceded by the sensation of nausea, which is an important part in the ordinary process of emetic action. An impression, therefore, is made on the stomach; this is followed by an impression on the nervous centres, probably in the medulla oblongata, and at the base of the brain; this excites the sensation of nausea, which is referred to the stomach, as any other sensation, touch, for instance, is referred to the point first acted on; as a consequence of this disturbance in the nervous centres, an influence is sent forth through the efferent nerves, to the stomach, the diaphragm, the abdominal muscles, the muscles of the larynx, and the sphincter fibres of the cardiac and pyloric orifices, which brings them all into simultaneous and concordant operation. That this nervous communication is essential is proved by two facts. If the par vagum on both sides is divided, the stomach will not act; and it is well known that, when the brain is rendered quite insensible by opium, so as not to be able to feel the impression made by the emetic substance, no amount of it will produce vomiting.

There is another interesting point of inquiry in relation to this subject. How is it that the impression upon the stomach is conveyed to the nervous centres concerned? I think there can be no doubt that it is, in some instances at least, conveyed by nervous communication; through the afferent fibres, namely, of the par vagum. Such a relation has been established between the gastric mucous membrane and the nervous centres referred to, that irritation of that membrane, from any cause, shall make itself felt in these centres, and thus give rise to nausea and vomiting. This is a wise provision of nature to get rid of irritating substances which may accidentally enter, or morbidly accumulate in the stomach. Hence, the presence of acrid bile often provokes vomit-

ing, as in cholera morbus; and acid matters have the same effect, as in sick headache. Even spontaneous irritation or inflammation equally excites the nervous centres, and causes nausea and vomiting. Irritant emetics are no doubt capable of operating in the same way.

But this is not all. Nausea and vomiting, being the direct result of a certain condition of the nervous centres induced by gastric irritation; must equally result from the same condition produced by any other cause. It is well known that certain diseased conditions of the brain, in a perfectly sound state of the stomach, very often occasion nausea and vomiting. Now if this state of the nervous centres can be induced by medicines, without directly affecting the stomach in any degree, they will equally produce vomiting, as though they operated through the stomach itself. Such is now well known to be the case. Various emetic substances will produce the effect when injected into the rectum, applied to the surface, introduced into the serous cavities, or thrown directly into the blood. Entering the circulation, they are brought with the blood into contact with the centres, and act on them directly, with the same result as though they operated primarily on the stomach. It may be said that they are carried to the stomach, and act primarily upon that organ still. This is not impossible. Entering into the mucous membrane with the blood, they may produce in it the same irritation as when applied directly to its inner surface, and this irritation may then react on the nervous centres so as to bring about vomiting. Indeed, it has been ascertained that substances which, like arsenic, inflame the stomach directly, are capable of producing exactly the same effect in it, when injected into the circulation. But there are reasons for thinking that some emetic substances act directly upon the nervous centres especially; and that, even when swallowed, they still act rather through absorption than directly on the stomach. Thus, medicines often operate as emetics, which are not in themselves very irritating; and this emetic effect is in no degree proportioned to their irritant influence. One grain of tartar emetic, dissolved in three or four fluidounces of water, is incapable of producing any sensible irritation of the mucous membrane; yet it will vomit actively; and it will produce the same effect, in whatever way it may enter the blood. The probability is, therefore, that even when swallowed, it acts not by an impression on the gastric surface, but by absorption, and direct action on the organic nervous centres.

Another consideration favours this view. Emetics do not generally operate at once. Time is required, and not unfrequently a considerable time, before their peculiar effect is experienced. It may be assumed that this time is expended in the process of absorption; and the effect is not produced until the blood has acquired a sufficient degree of impregnation for the purpose. If they acted by irritating the stomach, the effect should be more rapid. And this is the case with the emetics which really operate through their acrimony. Hence, an emetic dose of sulphate of copper, sulphate of zinc, or mustard, acts much more promptly than the same relative dose of tartar emetic, given with a view to its emetic effect.

From what has been said, it seems highly probable that emetics operate in three different methods; 1. by a direct and exclusive irritation of stomach, as mustard; 2. by absorption, as tartar emetic; and 3. by both methods, as probably ipecacuanha.

Effect of Repetition. Most medicines lose their effect, in greater or less degree, on repetition; more being required, at each successive administration, if the repetition be so frequent as not to suffer the system entirely to recover from the effects of the preceding dose. But emetic substances have been said to be an exception to this rule; and the fact is, that, when frequently repeated, they often operate in smaller doses after some time than at first. This, however, is only an apparent exception to the general rule. Emetics irritate the stomach. Their speedy repetition may increase the irritation into a state bordering on, if not amounting to inflammation. In this condition of the stomach, the mildest articles will often vomit, even a drink of water; much more a portion of the irritant emetic substance. Besides, the principle of association often influences the action of the medicine. Even the thought or recollection of a substance, which has once vomited, will sometimes, through this principle, produce an emetic effect. But if the emetic substance be given cautiously, beginning in such doses as not to irritate the stomach, and gradually increasing, as the organ is found to bear them; we may in this way enormously increase the quantity taken, without vomiting. Every one knows how insensible the stomach becomes to tobacco, though, on the first use of it, the smallest quantity produces sickness and vomiting. The stomach and nervous centres have gradually become accustomed to the impression, and consequently feel it less sensibly. In other words, the emetic substance obeys the general law.

Susceptibility to the Influence of Emetics. This is very different in different individuals, and in different states of system. Some persons, through idiosyncrasy, resist large doses of a particular emetic, and others are extremely susceptible to the smallest doses. In some persons, from six to ten grains of tartar emetic will not even produce nausea; and I once had a female patient whom ipecacuanha vomited in doses of one-sixth or one-quarter of a grain. In disease, the difference is very striking. Some nervous diseases offer a strong resistance to the emetic action. In delirium tremens, and mania, it is often extremely difficult to induce vomiting. Such, too, is the case often in amaurosis, tetanus, and cases of narcotic poisoning. The cause is probably the diminished sensibility of the nervous centres. The case is reversed in inflammatory and febrile diseases, in which vomiting is in general easily induced. Of the influence, in this respect, of the nervous element in disease, we have a remarkable example in spasmodic or catarrhal croup, consisting of a combination of laryngeal inflammation and spasm of the muscles of the glottis. In a child with this disease, a much larger dose of tartar emetic is required, to bring on vomiting, than in a simple case of inflammation of the same passages, as in ordinary catarrh. Mineral poisons are generally, in this respect, the reverse of the narcotic. Producing irritation of stomach, and not obtunding the sensibility of the nervous centres, they often vomit themselves; or, if not, favour the operation of small doses of emetics. An exception to this rule exists, when their action is so violent as to disorganize the stomach, and thus to destroy at once its susceptibility and absorbing powers.

2. *Therapeutic Effects, or Indications.*

1. *Evacuation of the Stomach.* This is an obvious and important indication for the use of emetics. Indigestible food, irritant or poisonous substances from without, acid and acrid accumulations resulting from chemical changes in the gastric contents or from disordered secretion, regurgitating bile and possibly pancreatic juice, may one or more be present in the stomach, and occasion irritation of that organ in various modes, requiring relief by means of an emetic.

One of the irritative affections in which an emetic is often indicated, on this score, is *severe spasmodic pain or cramp of the stomach.* Whenever this phenomenon is presented, inquiry should be made as to the probable existence of some cause of the kind referred to, and, if there be reasonable ground for suspecting its presence, an

emetic should be administered. One of the symptoms often present is some degree of nausea, but insufficient to bring about vomiting. One of the mildest emetics will generally be sufficient; and sometimes a tumblerful or two of warm water, or warm molasses and water, will answer the purpose, especially when occasional nausea is conjoined with the spasm. The relief from an emetic is often most prompt and complete, and the passage from intense suffering to ease most happy.

Another result of the same irritative agency is *frequent retching*, or *ineffectual efforts to vomit*, in which the patient may bring up a little bile, or acrid matter, showing the nature of the contents of the stomach, which, however, he is unable to empty completely. The suffering from the nausea, and racking of the fruitless emetic efforts, is often very great. This condition is not uncommon at the commencement, or in the course of fevers; in the former case, proceeding from undigested matters, which, in the disordered state of the digestive function incident to the febrile disease, the stomach is unable to dissolve; in the latter, from acrid secretion, particularly bile, which is sometimes produced in excess. If not relieved, the condition may end in positive gastritis, and may seriously aggravate the danger of the disease. I have not unfrequently met with it in the course of bilious remittent fever. Very gentle methods, as in the preceding condition, will here also answer a most excellent purpose.

I have repeatedly known a *comatose state, simulating apoplexy*, to result from irritation of stomach proceeding from acrid matters contained in it. One case of the kind I remember well, in which the condition apparently depended on a meal which the patient had made of cucumbers, ham, and I believe whortleberries. There are symptoms in these cases which usually serve sufficiently to distinguish them from true apoplexy. Though the attack may have been sudden, the face is not generally flushed as in congestion of the brain; there is no stertor, and the pulse is not specially full or strong. The patient, too, may exhibit some slight signs of consciousness if roused, and pressure in the epigastrium may occasion sensible uneasiness. An emetic will generally relieve the symptoms.

Urticaria frequently proceeds from this cause. The worst case of this disease I ever met with arose from eating raspberries, and ceased at once when the offending cause was discharged from the stomach. Other *acute skin affections* may sometimes have a similar origin, and be similarly relieved. By bearing this fact in mind, the

young practitioner will not unfrequently be able to save himself much solicitude, and the patient great suffering.

Sick headache is notoriously a frequent result of acrid or acid matter in the stomach; and may often be very advantageously treated by a mild emetic, given in anticipation, or aid of the spontaneous efforts of nature.

The indication for the use of emetics in *cases of poisoning by the stomach* is almost too obvious to require notice; but there are two or three points in connexion with the subject which it may be proper to touch upon. The narcotic poisons, not possessed of very acrid properties, especially opium, are apt to produce great insensibility to the action of emetics; and it is sometimes necessary to select the most prompt and powerful in order to obtain any effect. It is common to use for the purpose sulphate of zinc, or even sulphate of copper, and to give these in doses twice or three times as great as would be required under ordinary circumstances. The point to which I wish particularly to call the attention of the student here, is the necessity for caution not to proceed too far with these acrid, and even corrosive substances. Should the first dose not vomit, it should not be indefinitely repeated, in order to obtain this effect. Though the stomach and nervous centres may be insensible to the emetic influence, the mucous membrane nevertheless suffers from the irritation, and, if too much of the emetic has been given, when reaction takes place, should the patient survive the immediate operation of the poison, violent gastric inflammation may be added to other sources of inconvenience or danger. It would, therefore, be best, in such cases, after the administration of one or two doses, to be content with the very free use of one of the milder emetics, which may be given safely in any dose. Under the head of poisoning from opium, the reader will find an account of the methods by which, in these cases, the insusceptibility of the cerebral centres to the emetic influence may be diminished, and the medicine be enabled to act. In the poisoning from mineral and other highly irritant substances, it may often be sufficient to wash out the stomach by means of warm drinks; but, if these should not vomit freely and thoroughly, one of the milder emetics should be administered.

2. *Mechanical Compression of the Abdominal Viscera.* In consequence of the contraction of the diaphragm and abdominal muscles, the whole of the contents of the abdomen are powerfully compressed, and a tendency is given to the liquid matters contained in it to escape by every practicable passage. The blood of the vena portæ

and its radicals throughout the abdominal viscera, is thus hastened forward in its movement through the liver; and, should congestion of this circulation have existed, it is for a time relieved. Hence emetics are useful in *passive abdominal congestion*, and its attendant disorders. Cases of this kind are not uncommon. In warm weather, especially, the liver not unfrequently becomes torpid, the capillary circulation through it is slow and languid, and the blood accumulates in the vena portæ, producing various disorders of the stomach and bowels. One of the most common conditions is that often denominated *bilious disorder*. There is a feeling of oppression or weight in the abdominal region, the bowels are torpid, the appetite is impaired, the tongue is perhaps a little furred, there is a general uneasiness and often unaccountable depression of spirits, and not unfrequently, in the female, hysterical symptoms appear. This condition may be original, or may occur as an attendant on other diseases. An emetic often effectually relieves it by unloading the portal circulation.

In *congestions of the spleen*, this property of emetics will sometimes answer a good purpose; and they are among the remedies which may be resorted to in enlargements of that organ, supposed to be of a congestive nature.

Sometimes there is a collection of bile in the ducts of the liver, and in the gall-bladder, which interferes with the proper performance of the hepatic function; while, from the absence of the bile in the primæ viæ, the function of digestion is impaired. The compression to which these parts are subjected causes the ducts and gall-bladder to be emptied, and this source of disorder to be at least temporarily relieved. Hence the frequent appearance of bile in the matters ejected by vomiting, when the effort is repeated several times, and with some degree of violence. The bile, forced out of the liver and the gall-bladder into the duodenum, ascends partly into the stomach, and escapes along with its contents.

Sometimes there is reason to think that this bilious accumulation is owing to tenacious mucus, collected in the excretory ducts of the liver, which tends to close them against the passage of the bile. If this be the case, the emetic operates favourably by bringing the whole great power of the muscular walls of the abdomen to bear upon the obstruction, and thus forcing a passage of the ducts.

That these ducts are occasionally closed by *biliary calculi* is well known; and the idea formerly prevailed that jaundice was essentially connected with an impediment of this or some other nature

in these passages. Emetics, having been found useful in jaundice, were supposed to operate by forcing forward the calculus, or otherwise removing the impediment. Though I do not believe that jaundice usually depends on such a cause, yet it is sometimes associated with the obstruction, and is relieved by its removal; and it is probable that the mechanical action of emetics may prove useful in aiding the passage of biliary calculi, especially when associated with the general relaxation attendant on the state of nausea.

The simple shock given by these powerful movements to the contents of the abdomen generally, may tend to rouse them from any state of torpor into which they may have fallen, and thus serve as a general stimulant to all their functions.

3. *Reduction of Arterial Action.* During the existence of nausea, it has already been stated that there is a general depression of the circulation, the pulse becoming small and weak; and sometimes a condition approaching to syncope is induced. This diminished movement of the blood is useful in the relief of active congestion and commencing inflammation; and, could it be maintained, without great inconvenience, and perhaps danger, would serve as a most powerful antiphlogistic agency. Even temporary as it is, it sometimes serves a very useful purpose by *suspending the course* or *diminishing the violence of inflammation*, while other measures of a more permanent character may be used to sustain the impression made. One of the greatest drawbacks to the advantages of this influence of emetics is the subsequent reaction which is apt to take place; and which, after the disease has become fixed, so as not to be eradicated by any temporary measure, will probably do as much harm as the previous depression might have done good. It is best, therefore, when emetics are employed as such, in inflammations, to restrict them to the earlier stage; at least in reference to the present indication, that, namely, of reducing arterial action.

4. *Muscular Relaxation.* During the same state of nausea, there is a universal muscular relaxation, which often answers an admirable purpose in disease. Few agencies are more powerful than this in relieving spasm. Hence emetics are often extremely useful in spasmodic diseases. In the paroxysm of *spasmodic asthma* they are among the most efficient remedies. Their occasional repetition has been highly recommended in *hooping-cough*. They are above all other remedies effective in relaxing the spasm of the glottis in the paroxysm of *croup*, and are among the standard means of cure in that disease. Through the same agency, they often exercise a

powerful influence over the convulsive paroxysms of *hysteria*. They may indeed be employed in any case of spasm; where no contraindication exists, as cerebral congestion or abdominal inflammation; and when a strong immediate impression is desired. Even in *eclampsia* or occasional convulsions, with signs of cerebral congestion, if measures have been previously taken for relieving the brain by the abstraction of blood, purging, cold applications, &c., and the convulsions still persist, emetics may generally be given with safety, and will often be found of great benefit.

Another application of them, upon this principle, is made by the surgeons, for the purpose of relaxing the muscles in the *reduction of dislocations*.

5. *Promotion of Secretion.* During the continuance of the nausea, there is a strong and general tendency to secretion. The saliva generally flows copiously. The skin is almost always cool and moist. The bile flows more freely; and the same is probably the case with the pancreatic fluid. The mucous secretion is obviously increased, especially that of the stomach and duodenum, and of the air-passages. The last, indeed, is among the most influential therapeutic effects of emetics; rendering them of great use in inflammatory affections of the air-passages, and especially in *pseudomembranous* croup, in which they act favourably much more, I believe, by promoting mucous secretion, and thus loosening the false membrane, than by any merely expulsive effort. Indeed, it is difficult to conceive how this latter effect can be produced upon the air-passages, when, as one of the very conditions of the emetic act, the rima glottidis closes, and does not relax till the abdominal muscles cease to contract.

But, besides the general promotion of secretion from the relaxation everywhere of the blood-vessels, the hepatic and pancreatic secretions are probably increased upon other principles. The mere agitation of the viscera would have some effect of the kind by rousing them into increased action. Besides, there is a certain sympathy between glands, and the surfaces upon which their excretory ducts open, by which an irritation applied to the latter produces an increase in the function of the former. A familiar illustration of this principle we have in the increased flow of saliva which follows the introduction of food into the mouth. The irritation of the emetic upon the gastric and duodenal mucous membrane may be supposed to operate upon this principle, in promoting the secretion of bile and pancreatic liquor.

This general increase of the secretions renders emetics useful in various conditions of disease; whenever, indeed, there may be deficiency of action in any one of the surfaces or glands upon which they more especially operate, and of course in febrile diseases, in which there is often a general deficiency of secretions. It does not follow, however, that emetics are to be used in all these cases. Not unfrequently contraindications exist; and, when this may not be the case, there are generally other and less disagreeable methods of bringing about the same result. Nevertheless, the practitioner should be familiar with this therapeutic effect of emetics, so that he may have recourse to it, should the occasion offer.

One affection in which emetics often operate very happily, upon this principle, is *jaundice*. I have elsewhere endeavoured to demonstrate that, in the great majority of cases, this disease is the immediate result of diminution in the secretory function of the liver. Sometimes the cases are obstinate, and resist the ordinary hepatic stimulants. In such cases, emetics occasionally operate most happily; bringing, as they do, so many different agencies to bear upon that organ, all calculated to promote its secretory function.

6. *Depletion.* Emetics deplete in two ways; *first*, directly by increasing secretion, and *secondly*, indirectly, by removing from the stomach, and sometimes from the duodenum, materials which would otherwise make their way into the circulation, and increase or enrich the blood. Upon this principle, they are useful in *plethora*, *vascular irritation* or *active congestion*, and *inflammation*. But they are seldom used purposely with reference to this special effect; as the same ends can be accomplished by less disagreeable, and probably more effective means. Still they may act incidentally with advantage upon this principle, when given for other purposes; and their depletory effect should be taken into consideration, in estimating the indications for their use. It may turn the scale in their favour, when equally balanced by other considerations.

7. *Promotion of Absorption.* This property of emetics follows as a necessary consequence of their depletory powers. Whatever removes blood, or any constituent of the blood, from the circulation, favours absorption into it; and this is especially true of the liquid ingredients. The relaxed and flaccid condition of the blood-vessels has also, probably, the tendency to produce a contrary and balancing condition of the absorbents. By this property of pro-

moting absorption, emetics occasionally prove beneficial in dropsies; though seldom used purposely for this end. They have sometimes been employed, and with considerable efficiency too, upon this principle, to aid in the resolution of *obstinate swellings of the testicles*, and of the *absorbent glands*.

8. *Revulsion.* This principle in the operation of medicines has already been explained. (See *vol.* i. *p.* 52.) By their irritant action on the stomach, whether directly or through the circulation, they attract the arterial blood and the nervous energy to the gastric and duodenal mucous membrane, and thereby draw them from other parts where they may have been unduly concentrated. Upon this principle, in co-operation with others already referred to, they act beneficially in vascular irritation and inflammation, seated in remote parts. Hence, in part, their usefulness in *inflammations and spasmodic affections of the air-passages*, the *fauces including the tonsils*, and the *lungs*, when employed in their early stages. Hence too their powerful influence over *cerebral excitement*, especially when so managed as to sustain a nauseating effect, instead of being pushed to positive emesis. In congestion of the brain, of an apoplectic character, they are somewhat hazardous; but, when the excitement is mainly nervous, they often act very powerfully and advantageously. Few remedies are more efficient in *maniacal or delirious violence*, and cerebral excitement of a *hysterical character*, than emetics, so given as to nauseate. In *amaurosis*, dependent on irritation of the nervous centre of vision, they sometimes act happily. They have been recommended also in *delirium tremens*. In cases of *gout* and *rheumatism*, they operate usefully on the same principle.

In *hemorrhages*, too, they have been employed upon the same indication; and occasionally with considerable success, especially in that of the uterus.

In *neuralgic affections* they often operate beneficially, probably in part at least, upon this principle of revulsion. They may be tried in any obstinate case, but are more particularly adapted to the disease when it affects the head. The late Dr. Physick used to recommend them, as the most efficient means of cure, in those obstinate pains in the scalp, occupying the seat of a former bruise or other injury.

But, upon this principle, they cannot of course be used in inflammation or hemorrhage of the stomach itself, or the organs in its

immediate vicinity; though it is not impossible that, in other ways, they may prove useful in these affections.

9. *A Shock on the System.* The influence of emetics is rapid, powerful, and extensive. It is felt by the abdominal viscera, the brain, the heart, and, in fact, by every sensitive part of the body. They produce, therefore, a sort of shock upon the system, well calculated to rouse it out of torpor, and to unseat diseases which may have fixed themselves but recently, and with no great tenacity of hold, in the tissues. In this way they may break the chain of morbid associations, upon which the continuance of disease probably often depends. They substitute their own temporary influence immediately, or by anticipation, for that of other morbid agency, and thus operate on the principle of supersession. (See *vol.* i. *p.* 54.) It is in this way, probably, that they often prove efficacious in preventing the paroxysms of periodical diseases, being administered so as to be in full operation about the time of the expected attack. They will thus often prevent the paroxysms of *intermittent* and *remittent fevers*, and of *intermittent neuralgia;* and, upon the same principle, if given at the original approach of one of the miasmatic fevers, may altogether set it aside.

Emetics have been used in the *collapse of miasmatic pernicious fever*, and seem to have sometimes done good, by rousing the system into reaction.

It is possible that, in the same way, they may have been beneficial in the *collapse of cholera*, in which an emetic of salt has been very highly commended by some practitioners.

10. *Local Irritation.* The direct excitant effect of emetics on the gastric mucous membrane is sometimes beneficial in disease. In the torpid state of the stomach so common in *dyspepsia*, they were recommended by the late Dr. Chapman at the commencement of the treatment. By a local substituted action, they may also prove useful in existing irritations or other disorders of the stomach itself, on the same principle that irritants, externally applied, operate often so beneficially in eruptions upon the surface. But it would be difficult to distinguish those conditions of the stomach to which they might be applicable, from those in which their administration might be injurious; and, if used at all, with this indication, in such cases, it should be with great caution, and never when the membrane may be in any degree acutely inflamed. It is possible that they may sometimes prove useful, on this principle, in *cholera*, in which, as already stated, they have been recommended. It is, too,

not impossible that they may have been efficacious, as has been asserted, in arresting *hæmatemesis*, by the same mode of action. Certainly, we often meet with cases of gastric disorder, with a furred tongue, uneasiness of stomach, defective appetite, constipation, &c., in which an emetic affords prompt and entire relief. In the older pathology, these were looked on as saburral cases, in which the gastric mucous membrane was supposed to throw out unwholesome secretions, as the tongue forms fur; or noxious matters were in some other way generated, which, accumulating in the stomach, proved a source of various gastric disturbance. But these conditions are now looked on as having their real seat in the tissues; and emetics if useful, must be so by changing the condition of the tissues, and not merely by evacuating the sordes.

11. *Cathartic Effect.* Lastly, most emetics, given in doses just insufficient to vomit, are disposed to act as cathartics; and not unfrequently they produce the two effects conjointly. Some practitioners, availing themselves of this property of emetics, conjoin them in small doses with cathartics, to hasten, facilitate, or increase their action.

I have endeavoured above to point out all the principles upon which emetics may act beneficially in disease, and to put the young practitioner in the position of being able to decide for himself, in what special diseases, and in what particular conditions of each disease, he may judiciously have recourse to the medicines of this class. He will not unfrequently find several of the indications presented in the same case. Thus, in a case of *bilious remittent fever*, there may be occasion for the evacuation of the stomach, the excitation of the liver, and the supersedent shock upon the system; while the sedative, depletory, revulsive, and relaxing influence, and the increase of the secretions generally may be of incidental benefit. In *croup*, or spasmodic inflammation of the larynx, there is not only the indication for the relaxation produced by emetics, but also for their depletory and revulsive influence, and especially for their effect in increasing the mucous secretion of the air-passages. In the commencing stage of inflammations generally, the sedative, the depletory, and the revulsive effects may combine to diminish if not set aside the affection. But it would be impossible, with the limitation fixed for this work, to go through the whole list of diseases, and point out the several conditions in each, which may recommend or forbid the use of these medicines. This must be left to the judg-

ment of the practitioner, duly furnished with the principles which should serve him as guides.

Contraindications. It does not follow that an emetic must always be administered, when any condition exists which may be benefited by it. Emetics are very disagreeable medicines, and should, therefore, be avoided when they can well be dispensed with; in other words, when the same ends are likely to be accomplished in a little time by nature, or when they can be equally well attained by other less disagreeable means.

Positive contraindications are presented by active congestion of the brain threatening apoplexy, acute gastric inflammation, and the most advanced stage of pregnancy. It must be some very strong indication indeed, such for example as exists in a case of poisoning, that would justify the use of them in these conditions. The existence of hernia has been mentioned as a contraindication; but this is going too far. Hernia should always induce special caution in securing, by pressure, the hernial orifice, during the emetic act; but it should not be considered as forbidding the use of an emetic.

3. *Administration.*

Emetics should generally be given dissolved or suspended in water. Being irritant, they should be made to come in contact equably with the whole or large portions of the mucous coat of the stomach, and not, as when given in pill or solid mass, to concentrate their action upon a small part, with the effect, perhaps, of producing an unnecessary amount of irritation.

Another good practical rule, of general though not universal application, is to administer them, not at once in the full dose which experience may have determined as in all probability sufficient to vomit, but in smaller doses, to be repeated every fifteen, twenty, or thirty minutes, till they shall operate. Excess of effect is thus guarded against, in cases where the susceptibility may be greater than usual. Some of them are very uncertain in their dose, and especially require this precaution.

If intended merely to evacuate the stomach, they should be given with a considerable quantity of liquid, and aided, when they begin to act, by the free use of warm water, or warm chamomile tea.

If, on the contrary, a powerful impression is required upon the system at large; if it be wished to produce and keep up nausea, or strongly to compress and agitate the abdominal viscera by fre-

quent retching; then the medicine should be administered with little liquid, and none should be given subsequently to aid its operation.

When the effects of an emetic are wanted purely in relation to the system, as for the relaxation, the shock, &c., it is generally best administered on an empty stomach; but the existing indications so often require its immediate exhibition, that it is for the most part necessary or advisable to give it, without reference to the question whether the stomach may be full or empty.

In cases of excessive emesis from an over-dose, the vomiting may be checked by first administering freely draughts of warm water, or some mild demulcent beverage, so as thoroughly to wash out the stomach, and then giving one of the preparations of opium by the mouth or rectum, or both, and applying a strong sinapism to the epigastrium. From thirty minims to a fluidrachm of solution of sulphate of morphia may be given by the mouth; or from thirty to sixty drops of laudanum, with a wineglassful of mucilage, by enema. The latter will generally be found the most effectual.

4. *Auxiliary Emetic Measures.*

Various means are employed to facilitate or hasten the operation of the ordinary emetics; and not unfrequently these means are sufficient of themselves to provoke vomiting, when there is a strong disposition to the act.

Warm water, taken very freely, is one of the most efficient. From one to four tumblerfuls may be taken, at one or successive draughts; the water being lukewarm, and as nearly as possible of the temperature of the stomach. It operates partly by distension, and partly no doubt by a direct sedative influence; which seems to have a similar effect, with irritation of the stomach, upon the nervous centres, in producing nausea, though in a much less degree. When there is a disposition to vomit, without the ability to do so, or frequent but ineffectual retching, a large draught of warm water will often enable the stomach fully to discharge its contents, and afford great relief. Occasionally, however, when the irritation has been caused by the presence of acrid matter, the warm water, instead of vomiting, quiets the stomach, probably by diluting the offending cause, and facilitating its discharge through the pylorus. It has been stated already that, when it is desired to render the operation of emetics easy to the patient, warm drinks should be administered. These afford something for the stomach to operate upon, and obviate the

violent efforts at contraction, necessary to enable it to close over a small quantity of material. Warm water is also an excellent auxiliary to active emetics, in cases of narcotic poisoning, as it brings a new influence into play; that, namely, of distension. For this purpose, it should be given very largely, pint after pint, as long as the patient can be induced to swallow it, or until the stomach has been thoroughly washed out.

Chamomile tea, taken warm, is more efficient than warm water; as the flowers themselves have some degree of emetic power. It is used in the same manner and for the same purposes as warm water. The officinal infusion may be employed (see *vol.* i. *p.* 296) in the quantity of from six or eight fluidounces to a pint.

Tickling the fauces sometimes provokes vomiting, through an influence on the nervous centres, bringing the same muscles, to a considerable extent, into play, as in the case of ordinary vomiting. It is resorted to only when it is desirable to produce a very speedy emetic effect, or in cases of great insensibility of stomach, resisting the action of ordinary emetics. The process may be performed by means of a feather.

The emetics may be conveniently divided into those of vegetable, and those of mineral origin.

1. *Vegetable Emetics.*

IPECACUANHA. *U. S., Lond., Ed., Dub.*

Origin. Ipecacuanha consists of the roots of a small shrubby plant, growing in the forests of Brazil, where it is said to be collected chiefly by the aborigines. The same plant grows also in New Granada. The root is brought in bags or bales, chiefly from the ports of Brazil; but I have seen parcels which were said to have come from Caracas.

Sensible and Chemical Properties. As in the shops, the root is in pieces from two to four inches long, often much contorted, somewhat smaller in thickness than a goose-quill, and extremely rough from circular unequal rings, set close together, with fissures between them, generally deep, but in one variety rather superficial. There is often attached to the proper root, or mingled with it in mass, a portion of the underground stem of the plant, which is

easily distinguished by its smoothness, and, being inert, should be rejected. The colour of the root is usually dark-brown or blackish-gray, but sometimes brownish with a reddish tint, and still more rarely light-gray or ash-coloured. The powder is of a light grayish-fawn. The root is, when whole, inodorous, but in powder has a faint, peculiar smell, which in some individuals produces violent attacks of dyspnœa, resembling the paroxysms of spasmodic asthma. The taste is bitter, acrid, and nauseous. The sensible properties and virtues of the root are extracted by water and alcohol. They are said to be impaired by long boiling. Galls and other vegetable astringents produce precipitates with the infusion.

Active Principles. The principle upon which ipecacuanha mainly depends for its effects on the system is an organic alkali, called *emetia*, *emetina*, or *emetin*, which is probably combined with a peculiar acid named *ipecacuanhic acid*, at one time mistaken for the gallic. Emetia when pure is very powerful, sometimes operating as an emetic in the dose of half a grain. Both in a pure and impure state, it was at one time prepared and kept in the shops, under the impression that it might be substituted for ipecacuanha; but its violence, and the danger from over-doses have, with other causes, led to its entire abandonment; and it is now seldom or never heard of as a medicine. For further information in relation to it, the reader is referred to the U. S. Dispensatory. Besides emetia, there is a minute proportion of a volatile principle, upon which the odour of the root and probably its acrid taste depend; for the emetia is stated simply to have a slight bitter taste. This volatile ingredient is said to possess no emetic power.

Effects on the System. Locally, ipecacuanha is an irritant of considerable powers. Applied to the skin, it is capable of producing inflammation, and a vesicular eruption. The dust in contact with the eyes, occasions redness and high irritation. When air in which particles of the powder are floating is inhaled by certain individuals, it causes severe irritation of the air-passages, exciting in some violent sneezing, and in others a complete paroxysm of asthmatic dyspnœa, followed by copious expectoration. The case of a medical gentleman has been reported to me, in whom it occasions severe inflammation of the mucous membrane of his mouth, fauces, and respiratory passages. Pereira quotes a case in which the effects of the powder were so severe as even to endanger life. The assistant of a druggist, engaged in powdering the root, incautiously inhaled the dust for a period of three hours. He was attacked with vomit-

ing, followed by tightness of the chest, and afterwards with constriction of the throat, and a feeling as of suffocation; and had a pale and deathly appearance. Measures were employed for his relief with temporary success; but another attack came on, in which there seemed to be imminent danger of suffocation. A strong decoction of uva ursi with extract of rhatany was administered, with the apparent effect of giving almost immediate relief; but he continued to suffer several days with difficulty of breathing. (*Mat. Med.*, 3d ed., p. 1596.) The experiments of Bretonneau show that the powder, introduced into the stomach or rectum of animals, may produce severe inflammation of these parts. (*Trousseau et Pidoux*, 4e éd., i. 602.)

When swallowed in very minute doses, ipecacuanha appears to act as a tonic, increasing the appetite, and facilitating digestion; effects which are probably owing to a very gentle exercise of its irritant property. In doses somewhat larger, it acts as a diaphoretic and expectorant, appearing to have a special tendency to the pulmonary apparatus. Still larger doses nauseate; and, if the quantity be merely within the vomiting point, the medicine is very apt to purge. In the full medicinal dose, it acts as a rather prompt and efficient emetic, generally vomiting within twenty minutes, with considerable antecedent nausea, though less than that produced by certain other substances belonging to the class. The vomiting, though efficient, is not often violent; the powder being usually thrown off by one or two efforts; but occasionally the action is more prolonged, especially when the doses have been small, and several times repeated. In consequence of the facility with which the whole, or nearly the whole of the powder is discharged from the stomach, ipecacuanha is a very safe emetic, and may be given in very large doses, with little more effect than from the ordinary full dose. However large the quantity, the stomach usually discharges it by one or two acts of vomiting. Even when operating as an emetic, the medicine sometimes also proves laxative; but it is less apt to do so than tartar emetic. I shall here treat of the applications of ipecacuanha only as an emetic and nauseant. As a diaphoretic, expectorant, and local irritant, there will be occasion to consider it hereafter.

Therapeutic Application. The remedial virtues of ipecacuanha were known to the aborigines of Brazil. The first published account of it was by Pison, about the middle of the seventeenth century, who spoke of its virtues in dysentery. A physician named Legras afterwards endeavoured to introduce it into France,

but with little success. It at length became generally known through a young physician named Helvetius, who used it as a secret remedy in Paris, and, having been very successful with it in the treatment of dysentery, and cured the Dauphin among others, received honours and a large reward from Louis 14th.

In consequence of its general efficiency, comparative mildness, and entire safety, ipecacuanha is admirably adapted for all those cases in which an emetic is called for, with the object of simply evacuating the stomach. These have been pointed out in the general remarks upon the subject of emetics. There is one condition, however, of this kind, in which its unaided powers cannot be relied on; that, namely, in which a poisonous dose of opium, or other narcotic of similar powers, has been swallowed. In these cases, it is advisable to have recourse to one of the more powerful emetics; but even here, ipecacuanha should be used as an auxiliary, on account of the impunity with which very large doses may be taken.

Another condition in which ipecacuanha should be preferably employed, is when, at the same time that a mild effect only is desired, there is an indication for the frequent repetition of the emetic, and especially when the affection to be treated involves the respiratory passages. Hence it is applicable to cases of asthma, and to those of hooping-cough, in both of which its simple nauseating influence is often of great advantage. In the paroxysm of *spasmodic asthma*, it may be given in the full dose requisite for vomiting, and afterwards in nauseating doses, so as to maintain a greater or less effect, according to the severity of the symptoms, until the dyspnœa subsides. In the more violent attacks of *hooping-cough*, the same course may be pursued, but with greater reserve. A gentle emetic dose may be administered every two or three days, with smaller doses in the interval. In the early stages of *infantile catarrh*, an emetic of ipecacuanha will often also prove useful; and the same remedy is frequently employed in *croup*, though probably less efficacious than tartar emetic.

Still another condition in which the mildness of ipecacuanha gives it a preference, is when emetics are employed for a local irritant influence on the stomach; as occasionally in *dyspepsia*, *hæmatemesis*, and *cholera*, in which the remedy has been recommended.

Generally speaking, in *young children*, in *pregnant and puerperal women*, and in *persons debilitated by previous disease*, ipecacuanha should be selected, for the same reason, when an emetic effect is desired.

There is one complaint in which ipecacuanha has long enjoyed peculiar credit, and in which it has been supposed to have peculiar powers. It was in the treatment of *dysentery* that the remedy was first brought into notice; and, though perhaps less employed than in former times exclusively for this purpose, it has never entirely lost its credit, and still enters into the general treatment of the disease, in combination with other medicines, especially calomel and opium. It has been given in two different methods in dysentery; in one in large doses with a view to its full emetic effect; in the other, in smaller doses, repeated so as to sustain a nauseating impression, or operate on the bowels. According to the former method, a full emetic dose of twenty or thirty grains is administered, and repeated two or three times, at intervals of from six to twenty-four hours, according to the effects produced, and the severity of the symptoms. The remedy is applicable to any stage of the disease, provided the stools are still small, and bloody or mucous, without gangrenous odour, and unattended with general prostration. In the second method, from two to five grains are given, at various intervals of from one to three or four hours, until a purgative effect is produced; and the remedy is afterwards to be regulated by the state of the symptoms. Another method of using it, recommended by Mr. Playfair, is to give, at the beginning of the attack, from thirty to sixty grains of the powder with as many drops of laudanum. If it vomit, the dose is to be repeated. It is said that the remedy sometimes acts very promptly not only in the relief, but in the cure of dysentery; and by some it is looked on as almost a specific. It is unnecessary to resort to this supposition in explaining its operation. The diminished force of the circulation, the depletion, the derivation at the same time to the surface, through the perspiratory action of the medicine, and to the stomach, at the opposite extremity of the alimentary canal, through its local irritation; all these influences, with the increased secretion from the irritated surface, and the removal of the irritating feculent matters by catharsis, are sufficient by their co-operation to produce the results, without calling in the aid of any specific power.

The same method of treatment has been extended to diarrhœa; but in this affection the medicine is more useful in diaphoretic doses, of which more will be said hereafter.

As a nauseating agent, ipecacuanha has been much recommended in the hemorrhages, especially in that from the uterus; but it pro-

bably has no other effect than such as may depend on the depressed state of the pulse attendant on the state of nausea.

For meeting some of the other indications for emetics, ipecacuanha is inferior to other medicines of the class. Thus, when a vigorous compression and agitation of the abdominal viscera, or a strong general shock on the system, or great muscular relaxation and circulatory depression, are required, the object may be better obtained by tartar emetic; though ipecacuanha will often answer, when only a moderate amount of the effects referred to is indicated, and may often be advantageously conjoined with tartar emetic in doubtful cases.

Administration. The dose of the powder for the emetic effect is twenty grains, which may be repeated every twenty minutes until it operates. But the quantity required to vomit in different individuals varies exceedingly; and six, four, or even two grains will sometimes act. I formerly had a female patient whom a fraction of a grain uniformly vomited. For children the dose must be reduced proportionably with the age (see *page* 35); but the wine or syrup is more convenient of administration in the very young. The powder may be given suspended in a wineglassful of warm water, and its operation aided by draughts of warm water and chamomile tea.

An *infusion*, made with two drachms of the powder and six fluidounces of boiling water, may be given in the dose of a fluidounce, repeated as above.

As a nauseant, two grains of the powder, or a fluidrachm of the infusion may be given, and repeated every three or four hours, or at such intervals as may be necessary to maintain the impression.

The only officinal preparations of ipecacuanha, used for an emetic effect, are the wine and syrup.

Wine of Ipecacuanha (VINUM IPECACUANHÆ, *U.S.*, *Lond.*, *Ed.*, *Dub.*) is of such a strength that one fluidounce contains the virtues of thirty grains of the root, admitting this to be wholly exhausted by the menstruum. The full emetic dose for an adult is one fluidounce, for an infant a year or two old, a fluidrachm, which may be repeated every fifteen minutes till it operates. This is a very convenient emetic for children, and, if properly prepared from good root, is very efficient.

Syrup of Ipecacuanha (SYRUPUS IPECACUANHÆ, *U.S.*) is prepared by exhausting the virtues of the root by means of diluted alcohol, then evaporating sufficiently, and adding sugar. One

fluidounce of the preparation should have the strength of fifteen grains of the powder. It is peculiarly adapted to infantile cases. From one to two fluidounces for an adult, and from one to two fluidrachms for a child, may be repeated every fifteen minutes till it acts.

II. GILLENIA. *U.S.*

Syn. Indian Physic. American Ipecacuanha.

Origin. Two species of *Gillenia*, *G. trifoliata*, and *G. stipulacea*, are recognized by the U.S. Pharmacopœia as the source of this medicine. They are both herbaceous perennial plants, indigenous in this country; the former growing in the Atlantic section of the Union, the latter in the valley of the Mississippi, and both meeting in the region immediately west of the Alleghanies. The root is the part used, and is the same in character as derived from the two species.

Properties. The root is several inches in length, cylindrical, about the size of a quill where thickest, tapering, longitudinally wrinkled, with here and there circular fissures, and at certain points closely and shortly undulated, so as to have a knotty appearance. It consists of a thick, brittle, reddish cortical part, in which the virtues chiefly reside, and an interior tough, whitish, ligneous cord. The root, on its outer surface, is of a light-brown slightly reddish colour; the powder is reddish-gray. The former is nearly or quite inodorous, the latter has a feeble smell. The taste is bitter, without being acrid or nauseous. Water extracts the bitterness of the root, and acquires a reddish colour.

Medical Properties and Uses. Gillenia is tonic in small doses, and emetic when given more largely. It operates mildly and efficiently, and is thought to resemble ipecacuanha. It has been occasionally used as a substitute for that emetic; but is not much employed. The dose is twenty or thirty grains, to be repeated every twenty minutes till it acts. The tonic dose is two or three grains.

III. BLOODROOT.

SANGUINARIA. *U.S.*

Origin. This is another indigenous medicine; being the root or rhizome of *Sanguinaria Canadensis*, a small herbaceous perennial,

growing in woods throughout the United States, and sending up a pretty delicate flower, among those which appear earliest in the spring.

Sensible Properties. The root when fresh is two or three inches long, abrupt at the end, often contorted, about as thick as the finger, fleshy, of a reddish-brown colour externally, of a brighter red within, and abounding in an orange-coloured juice, which escapes when it is cut. It shrinks in drying, and, as kept in the shops, is in pieces from one to three inches long, flattened, much wrinkled, often with abrupt offsets and radical fibres attached, externally reddish-brown, and internally of an orange-red colour, and spongy consistence. The powder is also reddish. The odour of the root is peculiar and somewhat narcotic, the taste, bitterish, acrid, and durable. Water and alcohol extract its colour and medical properties.

Active Principle. The virtues of the root probably depend on a peculiar organic alkali, denominated *sanguinarina*, which was discovered by the late Dr. Dana, of New York. It is an acrid substance, and, though itself white, forms coloured salts with the acids, which, when dissolved in water, produce beautiful red solutions.

Effects on the System. Bloodroot is an acrid emetic, with narcotic properties. It is a local irritant of considerable power, producing inflammation when kept in contact with the skin, exciting violent irritation when snuffed up the nostrils, and operating like a caustic upon fungous surfaces. Taken internally, in moderate doses, it excites the stomach, increases somewhat the frequency of the pulse, and stimulates the secretions, especially that of the lungs, and, as some suppose, the hepatic also. More largely taken, it occasions nausea, and now reduces the force of circulation, and diminishes the frequency of the pulse. Dr. Eberle, in his work on Therapeutics, states that he had found it to have this effect, usually, after having been continued in moderate doses for eight or ten days. In the full dose, it produces vomiting. In over-doses, it acts as a poison, causing burning in the stomach, excessive thirst, violent vomiting, faintness, vertigo, dimness of vision, and great prostration.

Therapeutic Application. The medicine may be employed for the ordinary purposes of the emetics, but, from its irritant properties, is inferior to ipecacuanha, and is less used with this object, than as a nauseant, expectorant, and alterative. It has, however, been recommended as an emetic in croup; and may be employed appro-

priately in all cases, in which, along with an indication for emesis, there is a state of system demanding rather supporting than exhausting measures. For its expectorant and alterative properties, it has been highly recommended in various pectoral affections, and especially in pneumonia, in the advanced stages or typhoid conditions of which, it is considered by some as a highly valuable remedy. It has been found useful also in bronchitis acute and chronic, in asthma, and pertussis. In rheumatism, too, it has been used with supposed advantage, and has been recommended as an alterative in disease of the liver. It should not, however, be used in any case, during high febrile excitement, nor in acute inflammatory affections, until after due reduction by depletory methods.

Administration. The dose of the powder, as an emetic, is from ten to twenty grains, which should be given suspended in water. It has, however, been recommended to administer it preferably in the form of pill, in consequence of its irritating effects on the fauces when swallowed in the former state. But it might be questionable whether it would be best to bring it, in its concentrated state, in contact with the coats of the stomach, irritating as it seems to be to the mucous membranes. As a nauseating and stimulating expectorant, it may be given in the dose of from one to five grains. The medicine is sometimes given in the form of *infusion*, made in the proportion of half an ounce to a pint, of which the emetic dose would be about a fluidounce.

The officinal *Tincture of Bloodroot* (TINCTURA SANGUINARIÆ, *U. S.*) contains the virtues of two ounces of the root in a pint, and may be given as an emetic in the dose of two or three fluidrachms, but is much more used as an alterative and expectorant, for which purposes from twenty to sixty drops are given, every two or three hours, in acute cases, and three or four times a day in the chronic.

Sanguinaria has been employed topically for various purposes. The powder mixed with camphor has been used as an errhine in choryza. It is said to have repeatedly caused the disappearance of soft polypi, by being occasionally snuffed up the nostrils. It has also been applied as an escharotic to fungous ulcers. An infusion in vinegar has been used with benefit in obstinate cutaneous eruptions, as a gargle in the sore-throat of scarlatina, and as a stimulant to ill-conditioned ulcers.

IV. EUPHORBIA.

IPECACUANHA SPURGE. — EUPHORBIA IPECACUANHA. *U. S.*

LARGE-FLOWERING SPURGE. — EUPHORBIA COROLLATA. *U. S.*

Origin. Our national standard recognizes as officinal, under the above titles, the roots of two species of Euphorbia, the *E. Ipecacuanha* and *E. corollata*, the former often called *American ipecacuanha*, the latter *milk-weed* from its milky juice; both herbaceous, perennial plants, growing abundantly in different parts of the United States.

Sensible and Chemical Properties. The roots often penetrate deeply into the soil, are two feet or more in length, sometimes nearly an inch in thickness, and, when dried, are light and brittle. They are of a yellowish or grayish colour externally, whitish within, inodorous, and of a feeble not disagreeable taste, perhaps somewhat sweetish, and followed by a slight sense of heat or acrimony in the fauces. They yield their virtues to water and alcohol. Their active constituent has not been isolated, but, as in other Euphorbiaceæ, is probably an acrid principle. Their virtues are impaired by time.

Effects on the System. In a full dose, these roots generally operate as an emetic with considerable energy, producing several discharges; the ipecacuanha spurge being somewhat milder, as generally thought, than the large-flowering. Both of them are apt to act on the bowels as well as to vomit; and sometimes, when given in the ordinary emetic dose, purge exclusively. They are not, like ipecacuanha, safe in over-doses; but, when taken too largely, act with great harshness, causing much nausea, violent vomiting, hypercatharsis, and symptoms of general prostration. They should not, therefore, be employed under ordinary circumstances; but may be resorted to, in the absence of other safer and more certain emetics, when vomiting is indicated. The dose is from ten to twenty grains, which may be repeated in twenty minutes if necessary. As a cathartic, they may be given in the dose of five or six grains, and as a nauseating expectorant and diaphoretic, in that of one or two grains.

V. LOBELIA. *U. S., Lond., Dub.*

Lobelia has already been sufficiently treated of, in all its relations, except as an emetic. (See *page* 134.) It will be necessary to

say but a few words of it in this capacity. In its emetic operation, it is prompt and powerful, but is apt to be attended with distressing and continued nausea and relaxation; and, in some instances, it cannot be made to act, in any safe dose, or, indeed, in any quantity whatever. In these latter cases, its use, if persisted in with the object of vomiting, is liable to cause great and dangerous prostration; and death has in numerous instances taken place.

In view of the above facts, it would seem that lobelia was not calculated for ordinary employment as an emetic. Though it may often act well, and answer all the desired purposes, yet we have no right to expose a patient to the chances of danger or great inconvenience, to attain an object, which may be accomplished quite as beneficially, and without risk, by other medicines. The only circumstances which would justify the employment of lobelia as an emetic, are the absence of any safer medicine in cases of emergency, and the existence of symptoms which offer a strong indication for those effects by which it is distinguished; much nausea, namely, and great relaxation. Such an indication is presented in the paroxysm of *spasmodic asthma*, in which lobelia is efficient probably beyond all other medicines, and in *croup* when the disease refuses to yield to the ordinary measures. Even in asthma, as it will frequently afford relief in nauseating doses, it is, I think, better to use it in quantities sufficient merely to produce this effect, without vomiting.

When given as an emetic, the dose should not be repeated indefinitely, if preceding doses fail. As already stated, the most fatal results have followed this kind of reckless or ignorant use of the medicine. Unless the first two or three doses vomit, it should not be carried further; nor even so far, should symptoms of general relaxation exist. Under such circumstances, if vomiting be necessary, recourse should be had to other medicines.

The dose of the *powder*, as an emetic, is from ten to twenty grains; of the *officinal tincture*, about half a fluidounce; for an infant one or two years old, one or two grains of the powder, or from twenty to forty minims of the tincture.

Besides the above emetics, there are many other vegetable products which have this property in a greater or less degree, and a few which may be resorted to under peculiar circumstances, or in cases of emergency. The following appear to require a brief notice.

1. **MUSTARD.**—SINAPIS. *U. S.*, *Lond.*, *Dub.*—SINAPI. *Ed.*

Of the origin, sensible and chemical properties, and various effects and applications of this valuable medicine, there will be occasion to treat under the rubefacients. It is only the emetic

property which I propose to notice in this place. Powdered mustard acts with considerable promptness and energy as an emetic. This effect is probably owing to its direct irritant operation on the gastric mucous membrane. At the same time, it has a tendency rather to stimulate than to depress the system at large.

It is then as a stimulating emetic that it is specially characterized; and in this capacity it is usually employed. The cases to which it is peculiarly applicable are those of great torpor of stomach, and general weakness or prostration. When the stomach is quite insensible to ordinary emetics, mustard may be added to them with propriety. Hence its use in *narcotic poisoning*. It is specially adapted to cases of this kind, in which, either from the time that has elapsed, or the sedative character of the poison, there may be a prostrate state of the system, or such a condition may be apprehended. In the more advanced stages, therefore, of poisoning by opium, and immediately, in poisoning by hydrocyanic acid, digitalis, aconite, tobacco, &c., when there may be an indication for the discharge of the poison, mustard should be employed, either alone or with other medicines. It is also admirably adapted to the *cold stage of the pernicious miasmatic* fever, and indeed to a similar condition at the commencement of any other febrile disease, when the stomach is not already irritable, and there is a strong necessity for rousing the system out of its torpor. It has also been recommended, in the collapse, or approaching collapse of cholera, in order, by a powerful impression upon the gastro-intestinal mucous membrane, to check the exhausting discharges, as well as to produce an exciting effect upon the failing general powers. It may be given, moreover, with a similar view, in some cases of torpor from old paralysis, in which there is no reason to apprehend danger from excitement of the nervous centres, which may have been the original seat of the affection.

The *dose* of mustard as an emetic is a slightly heaped teaspoonful (about a drachm), thoroughly mixed with six or eight fluid-ounces of water. The dose may be doubled or tripled in cases of great insensibility of stomach. Copious dilution is desirable, in order to prevent too concentrated an effect on some one part of the mucous membrane. In over-doses, or improperly administered, it may induce gastro-enteritis, with vomiting, purging, &c.

2. SQUILL.—SCILLA. *U. S., Lond., Ed., Dub.*

Squill is to be considered hereafter as a diuretic and expectorant, in which capacities it is almost exclusively used. It is only neces-

sary here to state that, in the dose of from *six to twelve grains*, it will often vomit, though its operation in this way is somewhat uncertain, and occasionally harsh. In cases of laryngeal or bronchial spasm, complicated with inflammation, it may be resorted to with a view to its joint emetic, and expectorant effects, in combination with other medicines, as seneka, ipecacuanha, and tartar emetic, or alone, in cases of emergency, if it should happen to be at hand, and other emetics wanting. For these purposes, it may be used most conveniently in the form of one of its liquid preparations, as the tincture, vinegar, or syrup. (See *Squill*, among the expectorants.)

3. **TOBACCO.**—TABACUM. *U. S.*, *Lond.*, *Ed.*, *Dub.*

This has been fully considered elsewhere. (See *page* 125.) I introduce it here simply to say that, in the dose of about six grains, in persons unaccustomed to its use, it will generally vomit, and may be resorted to in urgent cases for this purpose. It is, however, so apt to produce excessive and distressing nausea, and at the same time is so uncertain in any special dose, that it is almost never employed for this purpose at present. It is poisonous in over-doses, but is said to be less dangerous, when exhibited by the stomach than by the rectum, because more apt to be discharged.

Besides the above products, the following may be used for an emetic effect, though all more or less uncertain, and most of them disposed also to act on the bowels:—The roots of different species of VIOLET (*Viola*), of the DAFFODIL (*Narcissus pseudo-narcissus*), of the SENEKA SNAKEROOT (*Polygala Senega*); the leaves and roots of ASARABACCA (*Asarum Europæum*), all in the dose of from thirty grains to a drachm; and the root of our indigenous INDIAN HEMP (*Apocynum cannabinum*), and DOG'S-BANE (*Apocynum androsæmifolium*), in the dose of twenty or thirty grains.

2. *Mineral Emetics.*

I. TARTRATE OF ANTIMONY AND POTASSA.

ANTIMONII ET POTASSÆ TARTRAS. *U.S.*—ANTIMONII POTASSIO-TARTRAS. *Lond.*—ANTIMONIUM TARTARIZATUM. *Ed.*, *Dub.*

Syn. Tartar Emetic.—Tartarized Antimony.

Tartar emetic is here to be considered only as an emetic. In its other relations it has already been fully treated of (see *page* 57),

or will be hereafter. With perhaps the exception of ipecacuanha, it is the most valuable and most employed of the whole class, and has properties which render it, for certain purposes, superior even to that medicine, though inferior for others.

Effects and Indications. Tartar emetic usually acts promptly and energetically, causing much nausea, and repeated and prolonged vomiting, with great general relaxation. In some instances, however, and in certain individuals, it operates as gently as any other emetic medicine. It is said to produce the same effects when injected into the blood-vessels, the serous cavities, or the cellular tissue, though with much less certainty. Applied to the rectum, or the skin, it is little disposed to act as an emetic; yet in the former position it is asserted occasionally to vomit; and I have repeatedly noticed the same effect attendant on its external use as a pustulating agent. It is more apt to purge than most other of the emetics ordinarily used.

Compared with ipecacuanha, it produces, as a general rule, more nausea, more frequent and protracted efforts at vomiting, greater muscular relaxation and arterial depression, and a stronger impression on the whole system. It is also more disposed to extend its action to the duodenum, and to cause bilious discharges.

From these qualities, the indications for its preferable use may be deduced. When the object is merely to evacuate the stomach, or to produce a gentle impression of any kind, or when it is necessary to repeat the emetic daily or at other short intervals, and always when vomiting is called for in an already highly irritated or inflamed state of the stomach, ipecacuanha should be selected. Tartar emetic is preferable when the object is to compress or agitate the abdominal viscera, to produce great muscular relaxation and circulatory depression, to supersede any particular morbid state by a shock upon the system, or to act energetically by revulsion.

Therapeutic Application. In reference to the abdominal viscera, this is the most effective emetic in cases of *portal and splenic congestion*, *torpor of the liver*, and *jaundice*. In this last disease, it sometimes operates very energetically in bringing about biliary secretion, and may be resorted to when the liver refuses to respond to its ordinary excitants. In the course of *bilious fever*, portal congestion and deficient hepatic secretion sometimes occur, with aggravation of the symptoms, and may generally be relieved by a dose of tartar emetic, if the mucous membrane of the stomach is not already inflamed, or highly irritated.

For the production of muscular relaxation, the medicine is extremely useful in *croup*, and of itself will often immediately check an attack of the catarrhal variety of that disease. There is reason, too, to suppose that, if employed early in the pseudomembranous variety, before the false membrane has formed largely, it will occasionally have the same effect. It is, however, frequently necessary to repeat the emetic once or oftener, and in quick succession, before the disease can be subdued; and its use should be accompanied with that of the warm bath at the same time. It might be supposed that the same property would render tartar emetic preferable to ipecacuanha in *asthma* and *pertussis;* and no doubt its immediate effects would be greater; but as, in these affections, there is usually occasion, when the emetic plan is adopted, for a frequent repetition of the medicine, ipecacuanha is on the whole preferable, as less liable to produce either serious gastric irritation, or general prostration of the system.

For producing the muscular relaxation, so much desired by the surgeon in *obstinate cases of dislocation*, tartar emetic is greatly preferable to ipecacuanha. It is here sufficient to obtain its full nauseating and relaxing effect; and it should be given with that view rather than to vomit; though it is not always possible to prevent the latter result.

For the same universal depression attendant on its nauseating operation, tartar emetic is often a most useful agent in subduing *the violence of the maniacal paroxysms*, of *acute delirium*, and of great *hysterical disturbance*, especially in the frequently recurring *convulsions of that affection.*

Through its powerful general impression or shock, it is peculiarly efficient in the interruption of paroxysmal diseases, whether remittent or intermittent, given so as to be in full action at the period for the recurrence of the paroxysm. Hence one of the indications for its use in *intermittent and remittent* fevers, and *paroxysmal neuralgia*. The same indication is offered in the *forming stages of fever*, when it is thought that a powerful shock will sometimes supersede the influence of the morbific cause altogether, or greatly moderate its violence.

From its energetic revulsive action, as well as its general depressing effect, tartar emetic is probably more successful in the subversion of inflammatory diseases, in their earlier stages, than any other emetic. Hence it has often been given at the commencement of *ophthalmia, catarrhal inflammation, tonsillitis, laryngitis*, and even *pneumonia*, with the effect of breaking up the disease; and is

sometimes employed for the same purpose in swelled *testicle*, *buboes*, and *synovial inflammation*.

The same revulsive influence renders it peculiarly efficacious in various nervous diseases, as *tic douleureux*, *obstinate headache*, *mania*, and *amaurosis*.

It is often used, in small doses, in connexion with purgative medicines, in order to increase their activity.

In doubtful cases, it should be combined with ipecacuanha, which gives it greater mildness and brevity of action, while the tartar emetic insures efficiency.

It is *contraindicated* in debilitated states of the system, and an inflamed or irritated state of the stomach.

Administration. The medium *dose* of tartar emetic required for vomiting is two or three grains. But, from the variable degree of susceptibility to its action in different individuals, and under different circumstances of disease, it is usually deemed advisable to give it in doses of one grain, repeated every fifteen or twenty minutes till it acts, each dose being dissolved in a tablespoonful of water. If, after the administration of six or seven doses, it should produce much nausea and general prostration without vomiting, a dose of ipecacuanha may be administered, to produce the emetic effect.

When the two are given together, two grains of tartar emetic and twenty of ipecacuanha may be mixed, and divided into two powders, which may be given diffused in water; the second at an interval of fifteen or twenty minutes, if the first should not answer the purpose.

Antimonial wine may be given to an adult in the dose of a fluidounce, or, what is preferable, in half the quantity; repeated, if necessary, at the usual interval. It is, however, much more used as an emetic in children than adults. The dose for a child, one or two years old, is from twenty to forty drops. In the paroxysm of croup, this may be increased to forty or sixty drops.

By *enema*, from six to twelve grains of the salt may be administered; but it will seldom be found to vomit.

In cases of threatened death from food, or other solid body lodged in the œsophagus, relief is said to have been obtained, in several instances, by throwing a solution of tartar emetic into the veins. Two or three grains of it dissolved in two fluidounces of water, is the quantity usually employed, though as much as six grains are said to have been given. Emesis has been brought on, and the foreign body thus forced upward, and discharged.

II. SULPHATE OF ZINC.

ZINCI SULPHAS. *U. S., Lond., Ed., Dub.*

Syn. **White Vitriol.**

For an account of the properties, effects, and general uses of this medicine, see *page* 413 of the *first* volume. At present we are to consider it solely as an emetic.

In this capacity, sulphate of zinc is characterized by promptness, energy, and the production of comparatively little nausea. It operates more speedily than any other known emetic except sulphate of copper; and, though the operation is very energetic, it is soon over, and leaves little prostrating effect behind it.

Sulphate of zinc was formerly much used as an emetic, but has been almost entirely superseded by ipecacuanha and tartar emetic. Producing little of that relaxing and prostrating effect which renders tartar emetic so useful in certain cases, it would seem to be applicable, by its peculiar properties, mainly to the simple evacuation of the stomach; but here ipecacuanha has the advantage over it of greater mildness. It seems to be much inferior to both these medicines as a nauseant, and promoter of expectoration and perspiration.

There is, however, one condition in which its promptness and energy render it very useful. In cases of *narcotic poisoning*, especially by opium, it is the most efficient medicine, next possibly to sulphate of copper, in our possession; and is even preferable to that emetic, as less dangerous. I have used it often, and believe that I have never found it to fail; though I have always employed ipecacuanha as an auxiliary. The latter may be given almost indefinitely; a teaspoonful being administered at a time, and repeated several times if necessary. The dose of the former may be thirty grains; but I should fear to repeat it more than once, or, at the furthest, a second time, for fear that, though it may not vomit, it might possibly inflame the stomach. (See *page* 423.) Sulphate of zinc is also adapted to cases of *poisoning by acetate of lead*, in which it acts as an antidote, as well as emetic, converting the salt of lead, as far as it goes, into a comparatively inert sulphate, and itself being converted into the acetate of zinc, which performs the part of the emetic. I have seen it used with prompt success.

Another affection, in which it has been specially recommended,

is pseudomembranous croup, in several cases of which it was employed by Dr. Francis, of New York, with success, after failure with ipecacuanha and tartar emetic, and under apparently hopeless circumstances. Of a solution, containing a drachm in an ounce of water, he gave a teaspoonful every ten minutes, which caused violent vomiting, and the rejection of the false membrane. (Eberle, *Mat. Med. and Therap.*, 4th ed., i. 85.) This practice is well worthy of imitation in a similar condition of things. Sulphate of copper has been recommended as peculiarly efficacious; but the salt of zinc is much preferable, if it answer the purpose, as less likely to cause dangerous gastritis.

In any case requiring simple evacuation of the stomach, should ipecacuanha not be attainable, or be forbidden by idiosyncrasy of the patient, sulphate of zinc may be substituted.

The dose, under ordinary circumstances, is ten grains; in narcotic poisoning, it may be thirty grains; in either case, to be repeated at intervals of about fifteen minutes.

III. SULPHATE OF COPPER.

CUPRI SULPHAS. *U. S., Lond., Ed., Dub.*

Syn. **Blue Vitriol.**

See *volume* i. *page* 407, for a general account of this medicine. As an emetic, it possesses properties closely analogous to those of sulphate of zinc, so that what has been said above of the latter, may be said of it also, with this exception, that, if there is any difference between them, the salt of copper is still more prompt, more energetic, and less disposed to nauseate than that of zinc. It is, moreover, more dangerous, being much more irritant and corrosive.

Like sulphate of zinc, too, it is used chiefly in cases of narcotic poisoning and pseudomembranous croup. In its application to the former purpose, the caution is still more necessary, to avoid a too frequent repetition of the dose, as, if it accumulate in the stomach, and remain long without vomiting, though it may give no signs of action during the state of insensibility, yet, upon the occurrence of reaction, violent inflammation may ensue, even though, in the mean time, the medicine may have been discharged. The dose should not, I think, be repeated more than once; and it would be best to administer it in no case until milder emetics had been tried without effect.

In *pseudomembranous croup*, sulphate of copper has been considerably used, since originally recommended by Dr. Hoffmann, of Darmstadt, in 1821, and more recently by Dr. Droste, of Germany, who had extraordinary success with it in the treatment of the disease. It acts almost immediately, and, by the violence of the vomiting, was thought by Droste to cause a separation and discharge of the false membrane more efficiently than any other emetic. The dose for a child from one to two years of age is a grain; from two to four years, two grains; and from the latter age to ten, about three grains. If complete relief is not obtained by the first dose, from one-quarter to one-half of a grain is, according to Dr. Droste, to be given every two hours; and of these smaller doses more than three or four are seldom required. (See *Am. Journ. of Med. Sci.*, xvii. 231.) There can be little doubt that this medicine will, like tartar emetic or ipecacuanha, cure nearly all the cases of ordinary spasmodic or catarrhal croup; and such, probably, were many of the cases of the disease treated by Droste, all of which recovered. But, in the pseudomembranous croup, it very often fails. In one instance, in which I used it, a tube of false membrane, two inches or more in length, was discharged; yet the child nevertheless died of the same affection, extending deeply into the bronchial tubes; and it is the tendency, I believe, to this extension, which renders the disease so terribly fatal; even tracheotomy offering little chance of relief under such circumstances.

The dose of sulphate of copper, under ordinary circumstances, is two or three grains; in cases of narcotic poisoning, from five to fifteen grains.

IV. YELLOW SULPHATE OF MERCURY.

HYDRARGYRI SULPHAS FLAVUS. *U. S.*

Syn. Turpeth Mineral.

Preparation. This is prepared by boiling mercury and sulphuric acid together to dryness, and throwing the resulting mass into boiling water. The sulphate of deutoxide of mercury is obtained in the first step of the process, which is decomposed by the hot water into a supersulphate, which remains dissolved, and the yellow subsulphate, which is deposited.

Properties. This mercurial is in the form of a lemon-yellow pow-

der, inodorous, of an acrid taste, and nearly insoluble in water, requiring 2,000 parts of cold, and about 600 of hot water, for solution. At a red heat, it is entirely dissipated.

Medical Effects and Uses. Turpeth mineral has long been used as an emetic, formerly much more than at present. Though operating with great promptness, and with little of the secondary prostrating influence of the antimonials, it has been considered as uncertain, sometimes failing to act, and sometimes acting harshly; and is liable to the disadvantage that, if not wholly rejected by the stomach, it is apt to salivate. These qualities unfit it for ordinary use as an emetic; but it is occasionally employed, repeated two or three times a week, in cases of obstinate swelling of the testicle, in which its mercurial influence may be desirable; and has, moreover, been strongly recommended, by Dr. Hubbard, of Maine, in the treatment of croup. Dr. Hubbard states that it is prompt and certain, that it is little disposed to act on the bowels, and prostrates less than other emetics used in the treatment of that disease. In the pseudomembranous variety, its disposition to affect the system would be rather in its favour than otherwise.

The ordinary emetic dose is five grains. For a child two years old, with croup, the dose is two or three grains, to be repeated, if necessary, in fifteen minutes. In over-doses, turpeth mineral acts as a *corrosive poison.*

Besides the mineral substances mentioned, there are many others which possess emetic properties; as, for example, *alum*, the *precipitated sulphuret and chloride of antimony*, the *acetates of copper* and *zinc*, *corrosive chloride of mercury*, &c.; and, in fact, almost all highly irritating or corrosive substances will occasionally provoke vomiting; but, with the single exception of *alum*, which is used in the treatment of croup, and of which sufficient has been said under the head of the astringents, not one of them, so far as I know, is at present habitually employed in this capacity. They are generally more or less uncertain, are liable to do serious injury in over-doses, and are susceptible of no useful application as emetics, for which those generally employed are not as well or better adapted.

CLASS II.

CATHARTICS.

CATHARTICS are medicines which evacuate the bowels downwards, increasing either the number or the quantity of the stools. They produce this effect in several distinct methods.

1. *Mode of Operation and Effects.*

1. Through an impression on the mucous membrane, they call the peristaltic movement of the bowels into greater activity. In this respect they only imitate the normal action of the contents of the alimentary canal, through the influence of which upon the mucous surface, propagated to the muscular coat, the healthy evacuation of the bowels is effected. How it is that this impression on the mucous surface affects the muscular layer, whether through a direct propagation by contiguous sympathy, or through the spinal or ganglionic nervous centres, is not certainly known; but, from the regularity of the combined peristaltic movements, and from the association with them of the action of the abdominal muscles, when the evacuation takes place, it is highly probable that the organic nervous centres are concerned. To a certain extent, a direct stimulation of the muscular coat may be effected by mechanical weight or distension from the alvine contents; and it is probable that purgation may sometimes be produced or aided in this way; but that such an influence cannot be the chief cause, is proved by the simple fact, that the cathartic often acts without adding anything appreciable to the weight or bulk of the contents of the bowels.

2. A second and very frequent method of action is by increasing the exhalation of serous liquid, and the secretion of mucous into the primæ viæ. The liquid thus poured out into the bowels stimulates the peristaltic movement, as the cathartic is itself supposed to do, according to the first method of operating.

3. Certain cathartics appear to operate mainly by stimulating the liver, and thus increasing the secretion of bile. It is probably through this secretion, operating on the mucous membrane, that the regular healthful action of the bowels is chiefly sustained. That the bile is actively purgative is proved by the fact that, when

secreted in excess, it almost always occasions either cholera morbus, or bilious diarrhœa. Medicines, therefore, which stimulate the hepatic secretion, must necessarily act as cathartics, and I believe it is in this way that the mercurials mainly operate. It is supposed that a similar effect is produced by an increase of the secretion of the pancreas, but we have no satisfactory proof of the fact.

4. Still another method is probably through absorption. We know that certain cathartic medicines are either wholly or in part absorbed, and enter into the circulation. Thus rhubarb and gamboge impart colouring matter to the urine; sulphur exhales, in the form of sulphuretted hydrogen, from the surface of those who take it freely; and the purgative principle of senna is said to be secreted with the milk. But a still stronger proof is, that several of the cathartics, as senna, colocynth, and elaterium, operate on the bowels, when brought into contact with the serous or cellular tissue, or injected into the blood. Aloes operates upon the same portion of the bowels, and in the same characteristic method, whether taken into the stomach, injected into the rectum, or applied to a blistered surface denuded of the cuticle. Whether, after entering the circulation, they act directly on the muscular coat of the bowels, or first on the mucous coat or nervous centres, and secondarily on the peristaltic function, is uncertain; but as, in either mode of administration, the drastic substances irritate or inflame the lining membrane, it is probably upon this that the primary impression is made, as well when they operate through the circulation, as when by immediate contact.

Certain cathartics act exclusively in some one of the preceding methods; but the greater number, though they may be disposed to act in one rather than another of them, conjoin two or more methods in a greater or less degree.

Different individuals of the class act on different parts of the alimentary canal. Thus, gamboge, which is apt to vomit, operates probably more especially on the stomach and upper portion of the bowels; aloes is well known to direct a peculiar influence to the large intestines, including the colon and rectum; while the neutral salts, castor oil, senna, &c., if they have any preference, affect specially the small intestines, though probably operating also, in some degree, on the whole extent of the primæ viæ. This tendency to one part of the bowels rather than another has been ascribed to the different degrees of solubility in the acting principle of the medicine;

the most soluble operating on the upper, and the least so on the lower portions of the track. It is probable that a medicine of very difficult solubility in the liquids of the stomach and bowels, whether originally so, or rendered so by the manner of preparing it, might pass the upper portion unchanged, and thus act more especially on the lower; but the fact is that, in relation to most of the cathartics in which this peculiar tendency is observable, there is no such peculiarity of solubility. Thus, the active principle of aloes, which operates on the lower bowels, is readily soluble; and it shows the same disposition, whether given in pill, or in solution. Nay, even when applied to the denuded surface of the skin, it is asserted still to operate preferably on the rectum and colon. The result, then, must be ascribed to some other cause than any mere modification of solubility. There is nothing remarkable in the fact. Some medicines have a tendency to act especially on the kidneys, some on the skin, some on the brain, &c. Why should there not be a similar election in relation to different portions of the alimentary canal? So far as any explanation can be given, in the present state of our knowledge, the fact must be ascribed to different susceptibilities of the several portions of the canal, arising from peculiarity of intimate constitution. The stomach and duodenum are so constituted as to be specially susceptible to the action of gamboge, while they do not feel the influence of aloes; and exactly the reverse may be said of the colon and rectum.

The character of the discharges varies with the mode in which the cathartic acts. Medicines which operate exclusively on the large intestines produce fecal evacuation more or less consistent. Such is the case with aloes and sulphur. Others, which act upon the whole extent of the canal, or particularly on the small intestines, of course evacuate the liquid contents of the upper bowels, and occasion liquid, but still feculent stools. Those which act by increasing serous exhalation, produce thin watery discharges, often very copious, but generally more or less coloured with feculent matter. Bilious stools indicate that the cathartic has operated on the liver. They are sometimes of a bright deep-yellow, sometimes green from the reaction of intestinal acids, and sometimes, when the bile is very concentrated, of a dark-brown approaching to black, but still yellow when in thin layers. Irritating cathartics sometimes cause mucous and bloody stools.

Cathartics are usually arranged in three divisions, based upon their difference in activity or energy. The mildest are denominated

laxatives; those of considerable energy, but not violent, simply *purges*, or *purgatives;* and a third set, which superadd severe irritant properties to their cathartic power, *drastic purges*, or simply *drastics.* Though, by varying the dose and mode of combination, much may be done towards obviating these differences of power; yet there is, in this respect, an inherent and distinctive character in many articles of the class; so that no increase of the dose would give energy to the feeble, and no diminution of it render the violent mild. Thus, there are some laxatives of which no amount that could be used would act energetically on the bowels; and some drastics which, though the purgative effect might be diminished by lowering the dose, yet, when given in quantity sufficient to operate at all, will generally be attended with griping pain or other sign of irritation.

1. *Laxatives* not only operate moderately, but with gentleness, that is without materially irritating the mucous membrane, even, as a general rule, when taken largely. They may occasionally produce griping pains; but these are usually owing to flatulence, consequent upon gaseous matters resulting from fermentation or other decomposition of the laxative itself, as in the case of the laxative fruits, and carbonate of magnesia, or from combinations formed by it in the bowels, as in the case of sulphuretted hydrogen formed from sulphur. The bowels are loosened rather than purged: the evacuations being feculent, and more or less consistent according to the special mode of operation, or the portion of the canal specially affected.

2. *Purges* may be considered, for convenience of arrangement, as embracing only those cathartics which are capable of operating vigorously on the bowels; but, in whatever quantity taken, are not likely to prove poisonous by inflaming the alimentary mucous membrane. They may exhaust by excessive depletion, but are not dangerously irritant. This statement is not intended to be absolute, but only general. Even inert substances may become dangerous, if given in quantities sufficient, by their mass, or acting mechanically in some other way, to interfere with the functions of the bowels.

3. *Drastics*, or *drastic purges* as they are usually called, are characterized by the property of irritating the mucous membrane, and, in over-doses, may produce serious consequences by exciting extensive and severe inflammation in that tissue. Even in their ordinary operation, they not unfrequently cause more or less nausea, faintness, griping pain, and tenesmus; but, in excess, these symptoms are much aggravated, severe vomiting and bloody stools occur, the abdomen becomes very painful and tender on pressure, the

extremities become cold, the pulse sinks, and life is involved in considerable danger.

The term *hydragogue* has been applied, as the name itself would indicate, to those cathartics which produce copious watery stools. This property belongs especially to the drastic purges, and it has been not unusual to consider it as embracing these alone; so that, in the mind of not a few, the idea of hydragogue cathartics is associated with something violent and irritating; but the fact is, that the saline purges are not less really hydragogue, and not less, therefore, entitled to the name than the more powerful drastics. When used in this work, or elsewhere by the writer, the term is made to express what it means; simply the property of producing watery evacuations, without reference to mildness or severity of action in other respects.

Griping pain is a very frequent attendant on the operation of cathartics. In depends on spasm of the muscular coat. This may be induced by various causes, and, as stated in the remarks on laxatives, is not always inconsistent with mildness of operation; as, for example, where it depends on the production of flatulence, which by distending the bowels, calls the muscular coat into irregular action. But it is sometimes caused by high irritation or inflammation of the mucous membrane, which operates in producing it in the same manner as in enteritis and dysentery. Originating in this cause, it is much more serious, and indicates a drastic character in the medicine. There is a third source of griping entirely differing from either of the above. It is the powerful stimulant influence of the cathartic, directed especially to the muscular coat. The griping is an excess of the directly stimulated peristaltic movement. It is in this way that senna produces its characteristic griping effect. The symptom, under these circumstances, indicates no violence of irritation exercised upon the mucous membrane, but simply an energetic direction to the muscular tissue. It may be painful, but is never dangerous, and may in general be easily controlled.

Another difference between cathartics is in their influence upon the system. Some, besides their cathartic effect, and the general depression consequent upon it, have a direct sedative influence on the circulation, and operate as refrigerants. Such are the saline cathartics generally. Others, on the contrary, appear to be tonic or stimulating, increasing the general temperature, and sometimes even the pulse. These are often called *warming cathartics*. Rhubarb, aloes, and elaterium have more or less of this character. Others,

again, seem to have no further operation upon the system than such as results from their action as cathartics. Among these may be ranked castor oil, jalap, scammony, &c. The operation of cathartics is apt to induce thirst; particularly that of the hydragogues. This is owing simply to the depletion they produce from the blood-vessels, a diminution of the contents of which, by a wise provision of nature, induces, probably through the nervous centres, the sensation of thirst, as a means of securing a supply of liquid to replace that which has been lost. The symptom may sometimes also be dependent on the irritation of the mucous membrane, and the arterial excitement which certain cathartics occasionally produce.

2. *Therapeutic Indications.*

Cathartics answer a number of very important therapeutic purposes, and are certainly among the most valuable of the classes of medicines. There can be no doubt, however, that they have been greatly abused. They afford temporary relief under so many circumstances, are generally so easy of administration, and so readily suggest themselves to those who may be too ignorant or too indolent to investigate disease thoroughly, and deduce just indications from an accurate knowledge of its nature, that the temptation to their abuse is almost irresistible. They are the great resource of empirics; and large fortunes have been built upon purgative pills. The use of them has become so common, that, among the vulgar, to take a dose of medicine, or of physic, is equivalent to swallowing a cathartic. Of course, such indiscriminate use of medicines, by no means harmless, must often lead to serious evil; and the physician should be careful not to be seduced, by the facility of practising medicine upon the cathartic plan, into countenancing, by his example, the general rage for self-purgation. He will very often have occasion to administer cathartics; but he should never do so unless in compliance with some clear indication, and should continue them no longer than is necessary for accomplishing the object aimed at.

1. Simply to *evacuate the contents of the bowels*, is probably the most important indication that cathartics are capable of fulfilling. For this purpose they are used, in the *first place*, in all cases of fecal accumulation, from *habitual* or *occasional constipation*, when the condition cannot be overcome without them. It is not necessary for me to consider here the causes, evils, and treatment of constipation. This subject belongs to the practice of medicine. But there is one consideration which may be appropriately introduced

in this place; namely, that, in the treatment of habitual constipation, cathartics should always be regarded merely as temporary agents, to be employed for the sake of obviating injury from the feculent accumulation, but not relied on for the cure. They are not really remedies for the constipation, which must be treated by other measures, calculated to enable the bowels to resume their healthy function. To confide in cathartics alone, would often be to confirm, and even to aggravate the evil. These remarks are especially applicable to the *costiveness of dyspepsia.*

When, however, *constipation is merely occasional*, dependent on some temporary cause, which has already ceased, or will soon cease to act, cathartics are to be employed as the chief agent of cure, so far as the constipation itself is concerned. Such attacks occur, now and then, in ordinary health; and the fecal accumulation may become so great as to threaten serious results. Here vigorous cathartics are often requisite, sometimes the most vigorous; and, after the bowels have been thoroughly evacuated, nothing more may be necessary than perhaps some modification of the diet, or other ingesta.

In relation to the *constipation which so frequently attends acute diseases*, as fevers, inflammations, and various nervous affections, it may be laid down, as an almost universal rule, that the bowels should be kept open, in order to prevent injurious reaction of the feculent matter on the constitution. There are very few diseases, indeed, in which cathartics are not often required on this score. A rule, however, as universal as that of the use of the cathartics, is that, for the fulfilment of the present indication alone, and when no other is offered for their employment, the mildest that will answer the purpose should be selected. It would be unpardonable to purge actively, merely for the removal of the constipation complicating other diseases, when mild measures will answer. Generally, for the purpose here referred to, a laxative should be employed daily, or every other day. It would seldom be proper to allow the patient to pass more than two days without a stool.

The same remark is applicable to the *constipation attendant on pregnancy*, in which the pressure of the uterus sometimes interferes with the proper action of the bowels, and laxatives are often useful, to be continued, as may be required, until the temporary cause has ceased.

But it very frequently happens that other indications for cathartics coexist with that offered by simple constipation, which may require medicines of a more energetic character; and great latitude

of choice necessarily exists. The physician has the opportunity for the exercise of much acumen and discrimination, in the adaptation of the cathartic, specially indicated by the constipation, to the attainment of other coincident purposes, which are constantly presenting themselves in the course of the disease, and, besides, in accommodating the cathartic employed to other circumstances of the case, as, for example, the state of the stomach, the strength of the system, and the preferences or idiosyncrasies of the patient.

Secondly, cathartics are employed, in compliance with the present indication, to remove unhealthy secretions which may be poured into the stomach and bowels, or other acrid matters which may form in them, through chemical changes in the ingesta, without reference to the existence or non-existence of constipation. Cases of this kind are often presented in *sick headache* from acid or acrid matter in the stomach, *diarrhœa* and *cholera infantum*, with similar matter, including acrid bile, in the bowels, and various *low forms of fever*, particularly *typhus*, or fevers of the typhous type, in which the vitiated secretions may act injuriously, not only by the depressing influence of the substances existing in the bowels, but by their absorption into the circulation, and the consequent vitiation of the blood. In cases of *causeless low spirits*, *hypochondriasis*, *hysteria*, *chorea*, and various anomalous nervous disorder, especially when attended with a foul breath, there is not unfrequently reason to suppose that the root of the evil exists in offensive matters accumulated in the primæ viæ, and operating injuriously, in part at least, through absorption. Whenever there is reason to suppose that this state of things exists, whatever may be the special disease under treatment, there is an indication for this class of medicines.

Thirdly, indigestible matters of various kinds, taken into the stomach, such as food of very difficult solubility, and the rind, seeds, and stones of fruits; insoluble medicines in excess; various inorganic bodies which are frequently from habit, whim, or other cause, taken into the mouth, and then accidentally or purposely swallowed; and all kinds of poisons; these various substances, either by the mechanical results of their presence, causing irritation or obstruction, their essential irritant property, or dangerous influence on the system through absorption, offer strong indications for the use of cathartics. *Colic*, *dysentery*, *enteritis*, and *obstruction of the bowels*, may all arise from causes of this kind, and be beneficially treated by the evacuation of the bowels.

In cases of *poisoning*, the general rule is first to evacuate the

stomach by an emetic, and, after this has been well cleansed, to administer cathartics, in order to expel any portion that may have passed into the bowels.

2. A second indication to be fulfilled by this class of medicines, is *depletion from the blood-vessels.* This they effect directly by producing secretion or exhalation from the blood, and indirectly by carrying out of the body the nutritious matter, which had been prepared in the stomach for absorption, and which would otherwise have been added to the mass of the blood. Hence, when properly selected with a view to meet this indication, they are extremely useful in almost all acute inflammations with a rich blood, in many cases of subacute or chronic inflammation, febrile diseases of sthenic action, and plethoric states of the system generally. It is obvious that, for this purpose, the saline cathartics are peculiarly adapted, not only by their hydragogue, but also by their sedative or refrigerant property.

3. A third therapeutic effect of cathartics is to *increase the secretion of the liver.* Of this I shall have occasion to treat fully when on the subject of calomel, which is, far beyond all others, adapted to meet this indication.

4. Another important indication is the promotion of absorption. This cathartics accomplish through their depletory influence. By this method of action, they often prove extremely serviceable in dropsy, in the œdema of inflammatory affections, and to a certain extent, probably, in tumefactions of various kinds.

5. Revulsion is another highly important effect of cathartics. For the principles of this mode of therapeutic action, the reader is referred to *volume* 1, *page* 52. Those cathartics are to be selected for the purpose which are capable of producing irritation, however slight, of the alimentary mucous membrane. Operating on the long track of the canal, though feebly on any one part, they produce a great aggregate revulsive effect, without sensible inconvenience to the patient. They are thus useful in all kinds of inflammation which admit of depletion, except when seated in the stomach and bowels themselves. In this position, if advantageous, they must act on some other principle than that of revulsion. They are peculiarly useful in cases of sanguineous determination to the head, producing *vertigo*, *headache*, *apoplexy*, and *hemiplegia*, in *febrile diseases attended with cerebral fulness*, in *inflammation of the brain and its meninges*, and in *rheumatic* and *gouty* disease. Even in the pure *neuroses* they may act favourably upon the same principle, calling

off nervous irritation from the points where it may have been accumulated. *Neuralgia* has been treated effectually by croton oil acting as a purgative; and the drastic cathartics have long enjoyed a certain celebrity in the treatment of *mania*. They are among the most useful remedies in *chorea*, and to a certain extent prove serviceable in *epilepsy* and *tetanus*. Whenever, indeed, there is morbid concentration of blood and nervous force, in parts more or less distant from the alimentary canal, and no contraindication exists, cathartics are called for upon the principle here adverted to. The choice of the particular cathartic must of course be governed by the special circumstances of each case; but the general rule may be laid down, that, the more powerfully it acts on the mucous membrane of the primæ viæ, the more effective it is likely to be as a revulsive agent; one caution, however, being always observed, never to carry the remedy so far as to excite inflammation of that tissue, which reacts injuriously upon the system, and, through the special sympathies of the stomach and bowels with other organs, as well as through the febrile condition produced, may counteract the very purpose for which the medicine is administered.

6. Still another principle on which cathartics act therapeutically is by *eliminating offending matters from the blood*. This, though probably a powerful principle of operation, is necessarily, in the present state of our knowledge, rather vaguely applied. In *fevers*, various *cutaneous eruptions*, *rheumatism*, *gout*, and cases of *defective or suppressed renal, and hepatic secretion*, matters probably accumulate in the blood, which cathartics aid in eliminating by increasing secretion into the bowels. They are among the best remedies in congestion of the kidneys with suppressed secretion, as in ordinary *nephritis* and *acute Bright's disease*, and they are almost indispensable in the treatment of *jaundice*.

It very frequently happens that several indications are offered in the same disease for the use of cathartics. In *fevers generally, of sthenic action*, they operate advantageously by removing offending matters from the bowels, by depletion, and by revulsion, especially from the head. In *bilious* and *yellow fevers* they superadd their cholagogue action to other beneficial influences; and, in the low or typhoid affections, and indeed in all fevers of long continuance, may be supposed to act usefully by depurating the blood. The

only contraindications to their use in fevers, is a degree of debility which forbids all depletory or exhausting measures, an already existing diarrhœa, and inflammation of the alimentary canal; and even these contraindications are rather relative than absolute.

In very low cases of fever, it may be altogether improper to employ any brisk, or energetic, or actively depletory cathartic; but there are articles of the class, such as rhubarb and aloes, which, instead of weakening, if judiciously used really invigorate the patient, both directly by a somewhat tonic or stimulant influence, and indirectly by removing unwholesome and depressing matters from the primæ viæ. Hence, the system in typhus fever not unfrequently reacts, under the judicious use of cathartics of this character.

But what is to be said of enteric or typhoid fever, which is characterized by the coexistence of enteritis, and frequently of diarrhœa? Nothing, certainly, can be more injudicious here than active purging. Yet, when there is, as sometimes happens, a disposition to constipation, or at least an insufficient action of the bowels, a very mild cathartic, such as castor oil in small doses, operates most happily by removing irritating matters. In such cases, a substance so bland in its action on the mucous membrane, is certainly less injurious than the accumulated, and often acrid and unwholesome secretions in the bowels.

In the *inflammations*, too, there are usually combined indications for cathartics; the two most prominent being depletion and revulsion, by which they act with great effect in these complaints. They are, indeed, among the remedies upon which most reliance is placed in the treatment, not only of the phlegmasiæ, which are attended with fever, but of chronic inflammation also. Of course, the hydragogue cathartics are the most efficient, and of these the saline, as being at the same time refrigerant. In many inflammatory affections, it is highly probable that impurities of the blood aid in sustaining the local disease, and that cathartics prove useful also as eliminating agents. The only points which might render their use questionable in inflammation, are the existence of great debility, the complication of diarrhœa, and the location of the inflammation in the alimentary canal itself. Attention is undoubtedly due to all these modifying circumstances; yet none of them must be considered as absolutely excluding the use of cathartics. In debility, the selection of the cathartic must be made in reference to that condition; in diarrhœa, though energetic substances of the class

might be forbidden, the milder are often called for to remove sources of irritation which serve to maintain the disease. In certain conditions of diarrhœa, few remedies are more efficacious than a dose of castor oil and laudanum, or a combination of magnesia and rhubarb.

In inflammation of the mucous coat of the stomach and bowels, cathartics are not called for as revulsives, yet they may and often do prove useful by removing offending causes, producing secretion from the congested vessels, and depleting from the portal circulation by promoting the secretory function of the liver. Hence, they have generally been considered as among the most efficient remedies in the treatment of *dysentery*.

In *peritonitis*, they are of more doubtful propriety; as, by the peristaltic movement they provoke, they cause the inflamed surfaces of different portions of the bowels to rub against each other, and cannot but aggravate the disease; producing, I think, more injury in this way than good by depletion, or by revulsion to the mucous membrane from the peritoneal. I am, therefore, not in the habit of using them to any considerable extent in this complaint, contenting myself with a thorough evacuation of the bowels in the early stage, so as to remove any feculent accumulation which might itself serve to provoke injurious peristaltic efforts, and afterwards with keeping the lower bowels open by enemata. In the *peritonitis* dependent on perforation, they should be avoided sedulously in all stages, and in any method of administration; the indication here being to keep the bowels as much at rest as possible.

There is another condition of *inflammation of the bowels* in which purgatives are liable to great abuse. The cases I allude to are those of *enteritis attacking the whole thickness of the bowel for a certain length*, and thus paralyzing its movements, so as to produce obstinate constipation, which has not unfrequently been mistaken for obstruction, and treated accordingly with the most energetic cathartics, to the great detriment of the patient. The cathartics will not pass, and are, therefore, apt to be rejected by the stomach; while they aggravate the disease, by the excessive efforts into which they stimulate those parts of the inflamed bowel that are still capable of contraction. The indications are here to keep the bowel at rest, deplete generally and locally, apply blisters, and give calomel and opium internally. When the inflammation subsides, the bowels are opened spontaneously, or with the aid of very gentle cathartics.

The *neuroses*, *dropsy*, *scrofula*, *cutaneous diseases*, &c., also not unfre-

quently afford conjoint indications for cathartics; but the principles already stated will be sufficient for general guidance in their use; and it is wholly unnecessary to go through all the categories of disease, and point out minutely the several circumstances in each which may call for, discourage, or forbid the use of these medicines.

3. *Administration.*

I need not suggest the importance, in the use of this class of medicines, possessed as they are of such diversified qualities, to adapt the one employed to the particular demands of each case. It often happens that a complaint, which is benefited by one cathartic, might be materially injured by another. In their administration, moreover, it should be borne in mind that they may often be advantageously modified by combination. Very frequently two or or more may be conjoined to meet coexisting indications. Thus, magnesia and sulphate of magnesia are often given together, when the object is at the same time to correct acidity, and procure the effects of a depletory and refrigerant cathartic. Calomel is administered with castor oil, to insure at once an operation upon the liver, and a thorough evacuation of the bowels.

There is an important principle which regulates the combination of the more powerful and drastic cathartics, by which their irritant property is diminished, without impairing their purgative efficiency. The fact has long been familiar to the profession, and numerous combinations of the kind have been made from time to time. The explanation of this apparently singular result, which I have given since I first began to teach Materia Medica, is that, as the several cathartics operate on different parts of the alimentary canal, or on different tissues, and the irritant effect is diminished for each with the diminution of the dose, the conjoint irritation is little felt, because diluted and spread over a large extent, while the purgative effect must necessarily be the aggregate of that of the several ingredients of the compound. A degree of irritation which, concentrated within very narrow limits might produce the most serious mischief, may be so weakened by extension as to become quite imperceptible. The *compound cathartic pills* of the U. S. Pharmacopœia, of which more will be said hereafter, were formed upon this principle, and have been found to answer well in practice.

The purgative effect of the cathartics is thought to be increased by tonics, and especially the bitter tonics. Thus, it has long been admitted, that senna will act on the bowels in smaller doses,

when associated with colombo, than when given alone. Bitters are often themselves cathartic in very large doses, and a part of their auxiliary effect, in the present case, may possibly be ascribed to that fact; but it is supposed, and as seems to me justly, that they are chiefly useful by the increased capacity of acting which they impart to the tissues. Nux vomica, which acts as an excellent tonic in small doses, is an admirable adjuvant of laxative cathartics, in atonic states of the bowels. It probably operates simply by giving a due nervous tone to the relaxed tissue, so as to cause it to respond more readily to its peculiar stimulus.

Many cathartics are apt to cause griping pain, or nausea. These disagreeable effects may be in great measure counteracted by suitable measures. The object may be attained in two methods; *first*, by combining with the cathartic some substance which may so far alter its chemical nature as to obviate the griping or nauseating property; or, *secondly*, by administering other medicines, which may prevent or relieve these effects by their physiological action. Thus, in reference to the first method, senna, which is very much disposed to gripe, becomes comparatively mild, in this respect, when combined with one of the alkaline salts, as sulphate of magnesia, or tartrate of potassa; and the irritant properties sometimes exhibited by aloes are supposed to be ameliorated by the addition of soap. Examples of the second kind of qualifying influence are offered by the effects of the aromatics in obviating nausea and griping, when given with the cathartics. Nothing is more common than this association. It is the anti-emetic and anti-spasmodic action of the aromatic which, in this case, counteracts the contrary action of the purgative; and not any influence of the one directly upon the condition of the other. On the same principle, carbonic acid water is an excellent vehicle for the saline cathartics, which it renders much more acceptable to the stomach, and less liable to be rejected in irritable states of that organ.

Cathartics should, as a general rule, be given upon an empty stomach. They not only act more rapidly in this way than when given on a full stomach, but also much more kindly and with less irritation. They come into more easy and complete contact with the mucous membrane, and have neither the task of extricating themselves from the load of partially digested food, nor that of carrying it with them.

When the most speedy and most powerful effect is required from a certain dose, the medicine should be given in the morning,

before breakfast, when the susceptibilities of the stomach and bowels have been recruited by rest. Very small doses of cathartics will often act efficiently, if given at this time.

If, on the contrary, it be desirable to operate as mildly, and with as little inconvenience to the patient as possible, and speedy action is not requisite, the cathartic should be given at bedtime. The susceptibility is diminished during sleep; and it not unfrequently happens that the medicine shows no disposition to act until the time of awaking in the morning; the patient having, in the mean time, been conscious of no nausea, pain, or other disagreeable effect.

Not unfrequently, opium or some of its preparations, when indicated on other grounds, may be usefully added to a cathartic at bedtime. It generally secures a night's rest; and, when its restraining influence ceases in the morning, the cathartic will act very kindly.

During the operation of a brisk cathartic, or somewhat before it begins, the effect may be rendered more lenient, by the exhibition of some mild beverage, as barley-water, molasses and water, thin gruel, chicken-water, &c.

Hypercatharsis may be best counteracted by from five to fifteen drops of laudanum, or an equivalent quantity of some other preparation of opium, given by the mouth, or twice or three times the quantity, administered by the rectum. A fluidrachm of the camphorated tincture of opium will generally be found to answer the purpose.

Cathartics, in conformity with their degrees of activity, may be arranged in the three divisions of laxatives, purges, and drastic purges.

1. *Laxatives.*

These have already been defined. They are indicated generally whenever the object, in the administration of cathartics, is simply to keep the bowels open, so as to imitate the healthful condition as nearly as possible. They are essentially bland in their operation; differing in this respect from most of the purges and drastics, which, however the dose may be diminished, even though the amount of purgative effect may be less than that from the laxative, exhibit generally some evidence of an irritant character, however slight. Thus a grain or two of aloes will often produce a stool; but a slight sense of irritation may be felt in the rectum during the operation, while an equivalent quantity of manna, magnesia, or

sulphur may act in a manner, not distinguishable in this respect from a healthy natural opening. Hence the importance of the laxatives in those affections in which there is any existing irritation of bowels, especially of the rectum.

In the constipation of dyspepsia, there is generally an indication for something more than a mere laxative effect. The bowels usually participate in the inertness which gives character to the complaint; so that medicines somewhat tonic or stimulant, such as rhubarb and aloes, are generally preferable to the pure laxatives. But to the constipation of convalescence, and that of pregnant women they are peculiarly adapted; as well as to that attended with hemorrhoidal affection, or prolapsus ani. In the latter complaints, which are often aggravated if not produced by the hardness of the feculent masses evacuated, even though there may be a passage every day, the laxatives are indicated in consequence of their effect in loosening or softening the stools, without rendering them in the least irritant.

The laxatives may be subdivided into two sets, one operating physically or mechanically, the other dynamically.

a. *Laxatives Operating Physically.*

Substances consisting of coarse grains, or of minute irregular fragments, not capable of solution in the gastric juice, often by their mere shape become a mechanical source of irritation to the alimentary mucous membrane, sufficient to stimulate the muscular coat into increased action. They may be considered as acting in the same manner as sand acts on the conjunctiva, though with infinitely less severity. Again, there are others which appear to operate mainly by their weight, putting the bowel somewhat as it were on the stretch, and stimulating the muscular fibre to contract, by the very tendency to lengthen it. Mustard seed are an example of the first, fluid mercury of the second. I shall treat first of the former set, and afterwards of the latter.

1. WHITE MUSTARD SEED.—SINAPIS ALBA.

These are the seeds of *Sinapis alba*, and will be more particularly described hereafter. They are noticed here merely in reference to their laxative property. They are of a roundish-elliptical shape, about as large as a middling-sized shot, yellowish, inodorous, and of little taste when unbroken. Their exterior coating abounds in a mucilaginous matter, which is extracted by hot water. In the dose

of a tablespoonful, they operate as a mild laxative, having a slightly stimulant influence on the mucous membrane, on account of which they have been recommended, and considerably used, in habitual constipation with a torpid or languid condition of stomach and bowels, as in dyspepsia, feeble gouty, rheumatic, and paralytic cases, and often in old people without special disease. It is possible that they operate in part by a dynamic property, stimulating the alimentary canal; but their effects are chiefly ascribable to the mechanical cause above referred to. They may be taken in molasses, or after immersion for a short time in hot water, by which the mucilage contained in their outer coating is drawn to the surface, and thus renders them slippery. If they should not operate, the risk is that they may accumulate in the bowels, and produce injury through obstruction, or by exciting inflammation. They are said to have proved fatal in the latter mode. Should, therefore, any considerable quantity have been taken, either without operating, or with insufficient operation on the bowels, they should be thoroughly evacuated by castor oil, or one of the saline cathartics. Cullen is said to have been the first writer who called attention to this use of mustard seed.

Other seeds would probably have a similar effect; and I have been informed that *flaxseed* are used by some habitually as a laxative; but the same objection lies against them all, of liability to accumulate in the bowels, and especially in the cæcum or appendix, producing obstruction, or inflammation, ulceration, &c.

2. WHEAT BRAN.

This is, under certain circumstances, an excellent laxative, operating in all probability, mainly, if not exclusively, by the slight irritation occasioned by the coarseness and angularity of its particles. A tablespoonful will generally prove laxative; but it is very seldom used in a separate state. In the form, however, of *bran-bread*, *bran-crackers*, *bran-mush*, &c., it is much, and often very advantageously used, as a laxative article of diet. When we consider that the lower animals fed on grain are seldom troubled with constipation, and call to mind that they eat the grain in its natural state, with its outer covering unseparated, we may, I think, justly conclude, that this kind of food was intended to be thus employed; and that the careful separation of all the coarser particles from our refined flour is one of the injurious results of high civilization upon health. We are apt to commiserate the peasants of Europe who are fed on black bread; but the probability is that they would be quite unwilling to exchange with us, as their homely bread is both

more wholesome, and more agreeable to the taste than ours. Sometimes bran-bread, &c., is made by mixing bran with ordinary refined flour; but a better plan is to make use of the unbolted meal. The bread thus prepared is coarser and darker than the ordinary kind, but is sweeter, and to many quite as palatable. It is peculiarly adapted to dyspeptic persons, with enfeebled or inert stomach and bowels; and should not be employed where there is any suspicion of the existence of gastric or intestinal inflammation.

3. METALLIC MERCURY.—HYDRARGYRUM.

Mercury, swallowed in the fluid state, often rapidly passes through the bowels, operating as a laxative by its weight in the manner above referred to. It has been given in cases of ileus arising from obstruction of the bowels, in the hope that its great weight might prove serviceable in disentangling the intestine, or forcing a passage through obstructing materials. In some cases, it is thought to have contributed to, if not produced a favourable result; but much oftener it has failed altogether; and, considering its liability to be retained in the bowels, and through chemical change to affect the system, it should be considered unsafe, and never used except under otherwise desperate circumstances. The metal has been given in quantities varying from an ounce to a pound or more.

Small leaden shot I have known to be used with an asserted laxative effect. They may operate both by their shape and weight; but I need not say are quite inadmissible for therapeutic use; as, though lead unchanged is not poisonous, yet it may readily undergo alterations in the bowels, which will enable it to be absorbed, and to produce its poisonous effects on the system.

b. *Laxatives Operating Dynamically.*

Of the substances belonging to this subdivision there are several, which, being generally considered rather as articles of diet than as medicines, will require only a few general observations. They may be included in the two categories of *sugar*, and of *saccharine and acidulous fruits.* After a brief notice of these, we will proceed to the consideration of the remaining articles of the section severally.

1. SUGAR.—BROWN SUGAR.—MOLASSES.—TREACLE.

It is very doubtful whether perfectly pure sugar is laxative; at least it can be but very slightly so; but, in the impure state in which we receive it from the cane, and in the form of molasses, it certainly has a tendency to operate gently on the bowels. The most laxative form of it is probably the kind of molasses, which constitutes

the residue after the crystallization of sugar from cane-juice, and with which we are supplied, in this country, chiefly from the plantations in Louisiana and the West Indies. That obtained from sugar-houses, which is the residue of brown sugar after refinement, and which is frequently called treacle, is next probably in laxative power; and brown or crude sugar is the least so of these three forms. They are useful as laxative articles of diet, in connexion with bread, mush, &c., and in cases in which the digestive powers are vigorous. In a stomach enfeebled by dyspepsia, or chronic gastritis, they are apt to undergo chemical change, generating acid, and causing unpleasant symptoms of gastric irritation, and sometimes sick-headache. They are specially adapted to cases of piles and prolapsus ani. The late Dr. Physick used to speak highly of the advantage, in the prolapsus ani of children, of a diet consisting of rye-mush and molasses.

2. SACCHARINE AND ACIDULOUS FRUITS.

Most of our ordinary edible fruits are laxative, as the *peach*, *apple*, *pear*, *strawberry*, *raspberry*, *blackberry*, &c.; and, during the season when they prevail, persons at other times habitually costive, if permitted by the state of their digestive organs to indulge in them, are apt to be relieved of this affection. The same is the case, and in a special degree, with the *tomato*. The imported *orange* and *banana* have the same quality. Even when dried or submitted to cooking processes, the fruits generally retain the same character. Several of the imported dried, or preserved fruits, are peculiarly laxative, and much employed for this purpose. Among the most effectual is the *fig;* but *tamarinds*, *prunes*, *raisins*, *dates*, &c., have more or less of the same character. All these substances are habitually prescribed as ingredients of a laxative diet; and in relation to some of them, their pulp is used in officinal preparations, particularly in that excellent laxative compound, the confection of senna. (See *Senna.*) Unfortunately, in those cases in which these fruits might be most useful as laxatives, in dyspeptic conditions, namely, of the stomach, it often happens that they cannot be used, in consequence of their difficulty of digestion, and their liability to occasion acid stomach, abdominal uneasiness, flatulence, &c.

I. MANNA. *U. S., Lond., Ed., Dub.*

Origin. Manna is the concrete exuded juice of *Ornus Europæa*, or *flowering ash*, and of *Ornus rotundifolia*, growing wild in the South of Italy, and in Sicily, where also one or both trees are cultivated for this product. It is obtained through incisions in the trunk; that which exudes in the hot and dry months of summer being the finest, while that obtained later in the season, when the weather is cooler and rainy, is of less value. The former is called *flake manna*; the latter, which is of variable character, may be divided into two varieties, one of which is a soft almost amorphous mass, named *fat manna*, and the other seemingly a mixture of fragments resembling the flake manna with a portion less or greater of the fat, and called *manna in sorts*, or *common manna*. It is only the *flake* and *common manna* which are found in our shops.

Sensible and Chemical Properties. Flake manna is in irregular pieces of various size, often several inches long, sometimes less than an inch, and frequently somewhat concave on one side, as if from concretion upon the trunk of the tree. It is very light, porous, brittle, somewhat granular or crystalline in structure, and of a whitish or yellowish-white colour. *Common manna* consists of small fragments like those of flake manna, mixed with a soft, viscid, amorphous, darker substance, and varies in appearance as one or the other of these ingredients predominates.

The odour of manna is feeble and peculiar; its taste, sweet peculiar, and often somewhat nauseous, but in the finest kinds scarcely disagreeable. It melts with heat, and is inflammable. It is soluble, with the exception of impurities, both in water and alcohol. Heated alcohol dissolves it very freely, and on cooling deposits a large proportion in a crystalline form. This is mannite, which may be obtained pure by a second solution and crystallization.

Chief Constituents. The characteristic ingredient of manna is *mannite*, which constitutes about 75 per cent. of the purer kind. This is a beautifully white, crystalline substance, inodorous and sweetish, and bearing a considerable resemblance to sugar, from which it differs in being insusceptible of the vinous fermentation. Besides this, there is in manna, a small proportion of *proper sugar*, and a little *yellow nauseous matter*, upon which its cathartic property is thought mainly to depend. Pure mannite, however, has been found to be slightly laxative.

Medical Effects and Uses. Manna is a very mild laxative, producing soft unirritating stools; though its operation is not unfrequently attended with flatulence, and a little consequent griping. It is adapted to infantile cases, to the constipation of pregnancy, and to hemorrhoidal affections attended with the same condition of bowels. Persons habitually costive, but not dyspeptic, may with advantage carry with them a piece of the finer kind of flake manna, and eat a little of it as required. It is, however, much more used in connexion with other cathartics, the taste of which it covers, while it aids their operation. The medicines with which it is most frequently associated are senna and magnesia.

The dose for full effect is one or two ounces; for a child, according to the age from one to four drachms. A drachm or two, however, will often act as a gentle laxative upon an adult. The flake manna may be given in substance; but the medicine is more frequently administered in solution, either in one of the aromatic waters, as peppermint water, or an aromatic infusion, especially fennel-seed tea.

II. PURGING CASSIA.

CASSIA FISTULA. *U.S.*—CASSIA. *Lond.*

Origin and Sensible Properties. Purging cassia consists of the fruit of *Cassia Fistula* (*Cathartocarpus Fistula*, Persoon), a large tree, indigenous in India and Upper Egypt, and introduced into the West Indies, whence our supplies of the medicine are derived. The fruit is a dark brown, cylindrical, ligneous pod, a foot or more in length by less than an inch in diameter, straight or slightly curved. The pods hang in numbers on the tree, and produce a loud sound by striking against one another, when agitated by a high wind. In the interior, they are divided by transverse woody partitions into cells, which contain a blackish pulp surrounding the seeds, of which there is one in each cell.

Pulp of Purging Cassia (CASSIÆ FISTULÆ PULPA, *U.S.;* CASSIA PRÆPARATA, *Lond.;* CASSIÆ PULPA, *Ed.*) is the part of the pod used. When the pods are fresh, it may be scraped out with a knife; but, as they are usually brought to us, they contain the pulp dried upon the walls of the cells; and it is necessary to bruise them, and treat them with boiling water, in order to soften it. The pulp is then separated by straining through sieves. It is soft, blackish, of a

slight rather unpleasant odour, and a sweet mucilaginous taste, often becoming acidulous through exposure. It contains sugar and gum; but its purgative principle has not been isolated.

Medical Effects and Uses. Cassia pulp is in small doses laxative, in larger purgative, and, when given very freely, is apt to produce nausea, flatulence, and griping. The passages themselves are unirritating. It might be used as a laxative in habitual costiveness, but is almost never given alone. The dose for an adult for laxative effect is one or two drachms, as a purgative one or two ounces.

A *Confection* (CONFECTIO CASSIÆ, *Lond.*) is directed by the London College, consisting of the pulp of cassia and tamarinds, manna, and the syrup of roses, the dose of which is about half an ounce for an adult. In this country, the pulp is used almost exclusively as an ingredient of the *confection of senna.*

III. SULPHUR.

SULPHUR LOTUM. *U. S.*

Sulphur has already been sufficiently treated of on all points, except in relation to its effects and uses as a cathartic, to which, therefore, our attention will be exclusively confined in this place. The *washed sulphur*, as designated by the U. S. Pharmacopœia, or the *precipitated sulphur* (see *page* 378), should be used for this purpose.

Sulphur is a gentle laxative, operating mainly if not exclusively on the lower bowels, and on the peristaltic movement, and producing soft, somewhat consistent, and unirritating passages. It is slow in its action, and not unfrequently causes griping in a greater or less degree, possibly owing to the generation of sulphuretted hydrogen, possibly to the exertion of a special influence upon the muscular fibres, and perhaps to both causes combined. It may be used as a laxative in *habitual costiveness*, and is well adapted to *dyspeptic cases*, and those complicated with *piles;* to the former by its mildness, and its elementary nature, which prevents the generation of offending products by its decomposition in the stomach; to the latter, by the blandness of the discharges it occasions. It may be employed also, preferably to other laxatives, when there is an indication for its alterative effect, in connexion with habitual constipation; as in chronic *rheumatic*, *gouty*, *neuralgic*, and *paralytic affections*, and *eruptions upon the skin.*

The dose is one or two drachms, which may generally be most conveniently given at bedtime, mixed with simple syrup or molasses, or suspended in a little milk. It is very often combined with cream of tartar, in the treatment of piles.

IV. CARBONATE OF MAGNESIA.

MAGNESIÆ CARBONAS. *U. S., Lond., Ed., Dub.*

Preparation. Carbonate of magnesia is prepared by precipitating a solution of sulphate of magnesia by another of carbonate of soda. Mutual decomposition takes place, with the formation of sulphate of soda, which remains in solution, and carbonate of magnesia, which subsides. In order to produce complete decomposition, the mixed solutions are heated for a short time to the boiling point. The precipitate, having been well washed and dried, is ready for use. The carbonate is heavy or light, according as the solutions are very strong or feeble.

Sensible and Chemical Properties. The salt is in the form either of a powder, or of cubical blocks, which are very light, perfectly white, smooth to the touch, without smell, and with very little taste. It may be considered, for practical purposes, as insoluble, requiring 9000 parts of hot, and 2500 of cold water for solution. It is dissolved, however, by carbonic acid water, probably in consequence of being converted into the bicarbonate.

It is supposed to be a compound of the neutral carbonate (containing one eq. of acid and one of base), with hydrate of magnesia.

Incompatibles. It is decomposed by the acids and acidulous salts, by potassa, soda, lime, and baryta, and by the soluble salts of iron, copper, zinc, antimony, lead, and mercury, most of which form insoluble carbonates with its carbonic acid. At a high heat, its carbonic acid and water are driven off, leaving the earth uncombined.

Medical Effects and Uses. Carbonate of magnesia is gently laxative, and highly antacid. In the latter capacity, it will be treated of hereafter. Its cathartic effect is attributable to the formation of soluble salts with the acids it encounters in the stomach and bowels; and, without the presence of acid in the primæ viæ, it would probably not act. Hence it is liable to accumulate in the bowels, if taken too often and too largely. Should it not operate,

after having been taken a sufficient length of time, it should be followed by acidulous drinks, such as lemonade; and, in cases of accumulation, these drinks should be administered in connexion with efficient cathartics, as sulphate of magnesia, infusion of senna, &c. Its antacid properties particularly adapt it to cases in which there is an excess of acid in the stomach and bowels, at the same time that a laxative effect is required. The particular affections in which it may be given are precisely those to which pure magnesia is adapted; and, in order that unnecessary repetition may be avoided, will be mentioned in connexion with that medicine. It has the advantages over magnesia, that it has less taste, and, in consequence of the carbonic acid given out when it is decomposed in the stomach, has a tendency to relieve nausea and vomiting. It should, therefore, be preferably administered, when it is desired to correct acidity of stomach, associated with an irritable state of that organ. Even when there is no absolute existing gastric irritation, the carbonate, probably from the same cause, often sits better on the stomach, and is less disposed to nauseate, than magnesia; and from this cause, as well as from its want of taste, it is preferred by many who habitually stand in need of an antacid laxative. By such persons, the lumps of the carbonate are sometimes carried about the person, and a small piece occasionally bitten off, as required. But the greater bulk of the carbonate, and the circumstance that the carbonic acid is sometimes evolved in the bowels, and gives rise to flatulent pains, outweigh its advantages as a general rule, and the magnesia is much more frequently used.

Administration. The *dose* of carbonate of magnesia is one or two drachms, which, for a child a year or two old, may be reduced to from five to twenty grains. It may be given suspended in water or milk. The neatest mode of preparing it for use is first to rub it up with a little syrup or ginger syrup, and then suspend it in water, mint water, fennel-seed tea, or milk.

It not unfrequently happens, in obstinate constipation or obstructive affections of the bowels, from various causes, that, when active cathartics have been employed unsuccessfully, and, if persevered with, only serve to aggravate the vomiting, the use of gentle laxatives, given in small and repeated doses, succeeds very happily; the bowels yielding to persuasive measures what they have obstinately refused to violence. Under these circumstances, the following combination often answers an excellent purpose. Two drachms of *carbonate of magnesia* and an ounce of *flake manna* are thoroughly

mixed with eight fluidounces of *hot fennel-seed tea*, previously prepared with a drachm of the seeds; and of the mixture, when cold, from one to two fluidounces may be given every hour or two until the desired effect is produced.

A *solution of carbonate of magnesia in carbonic acid water* may be prepared by forcing carbonic acid into a reservoir, containing water mixed with carbonate of magnesia. A preparation of this kind has been kept in the shops, under the name of *Dinneford's fluid magnesia*. So long as the preparation is kept in air-tight bottles, it will remain clear; but, if the carbonic acid be permitted to escape by exposure, the neutral carbonate of magnesia is deposited in crystals. The solution, however, has a disagreeable taste, and is in no respect superior, either in acceptability to the stomach, or effect on the bowels, to the carbonate given as above directed.

V. MAGNESIA. *U. S., Lond. Ed., Dub.*

Syn. **Calcined Magnesia.**

Preparation. Magnesia is prepared by exposing carbonate of magnesia to a read heat, which drives off the carbonic acid and water. Various circumstances influence more or less the physical character of the resulting preparation; so that it may be harsh or smooth, and light or heavy, according to the method used. These circumstances need not be detailed here, as they belong rather to pharmacy than therapeutics. Two varieties of magnesia are kept in the shops, one *light*, made in the ordinary officinal method, the other *heavy*, and prepared by processes somewhat peculiar to the several manufacturers, under whose names it is sold, as *Henry's Magnesia*, *Husband's Magnesia*, *Ellis's Magnesia*, &c. Both kinds are often kept in wide-mouthed four-ounce glass bottles, so as to prevent the absorption of carbonic acid and water from the air. Magnesia not unfrequently contains a portion of carbonate from insufficient calcination, and, what is much worse, some caustic lime, which gives it an unpleasant taste, and may interfere with its remedial effects. The former impurity is readily detected by the effervescence caused by the addition of a dilute acid; the latter by the precipitate produced, in a neutral solution of the magnesia in a dilute acid, by a solution of oxalate of ammonia, or bicarbonate of potassa.

Sensible and Chemical Properties. Magnesia is a very light, perfectly white powder, without smell, and of a slight alkaline taste. It may be considered, for remedial purposes, as insoluble in water; more than 5000 parts of cold, and 36,000 of boiling water being required to dissolve it. In this greater solubility in cold than hot water, it resembles lime. It consists of one equivalent of a peculiar metal called magnesium, and one of oxygen. It forms soluble salts with most of the acids; and the solutions of these salts are precipitated by the alkaline carbonates, though not the bicarbonates, and by a mixture of ammonia and phosphate of soda; the ammoniaco-phosphate of magnesia being thrown down in the latter case. Magnesia decomposes most of the native salts of the vegetable alkaloids, causing precipitation of the insoluble base.

The *heavy magnesia* (Henry's, &c.) is much heavier than the ordinary kind, usually smoother, and more readily miscible with water, and on these accounts is often preferred.

Medical Effects and Uses. Magnesia is at once antacid and laxative. It is probably solely by combination with the acids of the primæ viæ that it is enabled to operate on the bowels; and consequently it is a soluble salt of magnesia that really acts. Hence, its essential nature as a cathartic must be the same as that of the saline cathartics generally (see *saline cathartics*); though it is much feebler, in the ordinary doses in which they are respectively given. From the limited amount of acid in the primæ viæ, no amount of it, however large, can in general be made to act so powerfully as a full dose of one of the purgative salts, unless its administration is accompanied with that of an acid. It may, therefore, be considered as belonging properly to the laxatives. Its great advantage, independently of its mildness, is its property of neutralizing acids in the alimentary canal, which renders it useful in a large number of diseases. It is applicable to all cases which offer joint indications for an antacid and very mild cathartic. It is of great service in *dyspepsia*, and will often afford relief to very unpleasant gastric symptoms in that complaint. *Sick-headache*, dependent on acidity of stomach, is relieved by it, and, if anticipated by the administration of magnesia, upon the occurrence of its first preliminary symptoms, may often be prevented. *Diarrhœa* not unfrequently, especially in children, either originates in, or is sustained by, an excess of acid in the stomach and bowels, and may be advantageously treated with magnesia in its earlier stages, especially in connexion with rhubarb. The same may be said of other affections of the in-

testinal canal in children, as *vomiting*, *colic*, and *flatulence*. In many *cutaneous affections*, it proves extremely useful by correcting the acidity of the primæ viæ, by which they are produced or aggravated. This is especially true of *urticaria*, *strophulus*, and *lichen;* and it is a good general rule, in the treatment of cutaneous diseases, to employ magnesia, alone or in combination, when a laxative effect is demanded. In *gout*, so often complicated with an excess of acid, magnesia is very useful; and it is often administered both in this disease and *rheumatism*, in connexion with sulphate of magnesia, or some other of the saline cathartics, and the wine of colchicum.

In the course of *febrile diseases*, and *inflammatory affections* of all kinds, it not unfrequently happens that the indications for this laxative are presented. To *children* it is peculiarly appropriate, by its comparative want of taste, and its mildness, and is very often called for in consequence of their extreme proneness, in almost all their diseases, to an excess of acid in the stomach and bowels. Freshly precipitated magnesia may be used as an antidote to arsenic, in the absence of the hydrated sesquioxide of iron.

Administration. The laxative dose of magnesia is for an adult half a drachm or a drachm; for a child one or two years old, from two or three to ten or fifteen grains; but the largest of these doses may often be exceeded with propriety, in infantile cases, when a purgative effect is indicated. It may be administered simply mixed with water or milk, or, as in the case of the carbonate, by being first rubbed with syrup or ginger syrup, so as to enable it to make a smooth mixture. As often given, it is apt to leave minute lumps in the mouth, between the teeth, which sustain a slightly unpleasant taste, and by association with the occasional nauseating effect of the medicine, give rise sometimes to an unconquerable aversion to it. This may be obviated by administering it as above recommended. One of the aromatic waters or infusions, or carbonic acid water, may often be used with advantage as the vehicle.

In administering a fluid mixture of magnesia, it must always be remembered that, in certain proportions of the ingredients, the liquid solidifies, so that it cannot be exhibited. A mixture of ten parts of distilled water and one of freshly calcined magnesia will become solid in twenty-four hours. Not less than fourteen or fifteen times its weight of water should always be employed. The conjecture has been advanced, that the medicine might sometimes do harm, if given with too little of the liquid vehicle, or in the state

of powder, by solidifying the contents of the stomach. Like the carbonate, magnesia may sometimes accumulate injuriously in the bowels, if it meet with insufficient acid. The remedy is to give freely of acidulated drinks with cathartics.

2. *Purgatives.*

The purgatives may be arranged in the three subdivisions of the vegetable, the saline, and the mercurial.

a. *Vegetable Purgatives.*

In this subdivision I include castor oil, rhubarb, aloes, butternut, senna, American senna, jalap, and may-apple; though this position of jalap may be somewhat doubtful, as it has hydragogue properties and a certain amount of acrimony, which render it closely analogous to the drastics, from which it differs only in being somewhat milder.

I. CASTOR OIL.

OLEUM RICINI. *U.S., Lond., Ed., Dub.*

Origin. Castor oil is obtained by expression from the seeds of *Ricinus communis*, or *palma Christi*, a plant which, in its native climate of the East Indies and Northern Africa, has the character of a tree, but, as grown in extra tropical latitudes, is usually annual. It is cultivated largely in certain parts of the United States, for the sake of its oil. The seeds, which are contained in a roundish three-celled, glaucous capsule, from which they are expelled when ripe, are about the size of a small bean, oval, very smooth and shining, mottled on the surface, and with a small projection at one end, giving to them somewhat the appearance of a tick, from which the plant has derived its generic name. They are powerfully cathartic and often emetic; three of them being generally sufficient to operate on the bowels, and seven or eight acting with great violence. This property depends on an acrid principle which pervades the whole kernel, and is in some degree no doubt extracted with the oil.

Castor oil, though capable of being separated by decoction, or by the agency of alcohol, is at present obtained for medical use, at least in this country, exclusively by expression. After having been expressed, it is clarified by boiling with a little water, by which the albumen is coagulated, and any gummy matter dissolved, and

which answers another good purpose by driving off a portion of the acrid principle, and thereby rendering the oil milder. It is very important not to carry the boiling too far; as, if altered by heat, the oil acquires acrid properties, which wholly unfit it for the special purposes it is calculated to fulfil.

Sensible and Chemical Properties. Castor oil is a thick, viscid liquid, colourless when quite pure, with little odour, and a taste at first mild though somewhat nauseous, but afterwards slightly acrid. As kept in the shops, however, it is not unfrequently more or less yellowish or brownish, with an unpleasant odour, and a much stronger and more nauseous and acrid taste. It ranks among the drying oils; those, namely, which become hard and translucent upon exposure. It is not congealed by cold, but sometimes deposits a whitish matter in winter, which is redissolved in warm weather. Though lighter than water, it is heavier than most other fixed oils, from which it differs, also, in being soluble in all proportions in absolute alcohol; by which property its purity may be tested. It is dissolved also by ether. Its ultimate constituents are carbon, hydrogen, and oxygen; but its proximate composition has not been definitively settled. It is supposed, however, to contain two or more distinct fatty principles, which yield as many distinct acids on saponification. These acids are more or less acrid; and as they are also partially developed by heat, the injurious influence of this agent on the oil may be readily understood.

It has been made a question, whether castor oil depends for its purgative property on the acrid principle of the seeds, or upon its own inherent constitution. From the peculiarity of its cathartic operation, I am disposed to think that the latter is the cause. Fixed oils generally are somewhat laxative; and there is no reason why castor oil may not possess the same property in a higher degree. It has been urged, in relation to the coloured and acrid specimens of the oil, that they are really preferable to the pure, because more powerfully purgative; but they are also more acrid, and it is the characteristic mildness of the oil that gives it peculiar value. We have numerous active purgatives, but none which combine, in an equal degree, blandness with efficiency. The purer, therefore, and the more free from smell and taste the oil can be obtained, the better is it calculated to answer the purposes for which it is used.

Medical Effects and Uses. Castor oil is characterized, as a cathartic, by promptness, gentleness, and efficiency. It is among those which operate most quickly on the bowels, not unfrequently

producing its effects in two or three hours; though, in certain conditions of the alimentary canal, and in certain individuals, it is retained long in the stomach; and I have known it to be thrown up twenty-four hours after it was taken, without having affected the bowels at all. Dr. Ward mentions the case of a woman in whom, instead of acting as a cathartic, it appeared to be absorbed, and exuded from all parts of the surface. (*Lond. Med. Gaz.*, x. 377.) Its operation is usually attended with little pain or uneasiness of the bowels; and the discharges obtained by it are mainly the feculent and liquid contents of the alimentary canal, with which the oil itself is generally to be seen mixed in various states. It is, therefore, inferred to act chiefly, if not exclusively, by promoting the peristaltic motion. It not unfrequently nauseates, and is sometimes thrown up from the stomach. This is particularly the case with the acrid oil; but it happens also with the purest. The vomiting, I believe, is generally ascribable, not to the direct influence of the oil on the stomach, but to associations previously formed of its taste with the somewhat nauseating effect of previous doses; so that the very thought of it becomes offensive. I have known individuals who had this repugnance so strongly that, though they might compel themselves to swallow the oil, it was rejected instantly by a sort of spasmodic effort, before it had the opportunity of making any impression whatever on the stomach. By young children it is almost uniformly retained in the ordinary state of the stomach; and it is very seldom rejected by adults, in a similar condition of that organ, who have not formed the nauseating association referred to. In regard to its mode of operation, I believe that it is exclusively local. This is to be inferred from the rapidity of its action when it does act; and when not, from its being retained so long in the stomach, showing that it is not absorbed. It is said, however, when thrown into the veins, to produce griping and purging, and to cause an oily taste in the mouth. (Pereira, *Mat. Med.*, 3d ed., p. 1291.)

The peculiar character of castor oil as a cathartic suggests its therapeutic application. It may be used in all cases where the indication is simply to evacuate the contents of the bowels, and to effect this object as speedily, and with as little irritation of the mucous membrane, as possible. From its demulcent nature, it is peculiarly adapted to those cases in which the mucous membrane is already irritated or inflamed.

In cases of *colic*, dependent on feculent accumulation, acrid secre-

tions, or indigestible substances in the bowels, it generally answers an excellent purpose; not unfrequently, in connexion with aromatics or opiates, affording complete relief.

In all cases of *occasional constipation*, *feculent accumulation*, or *obstruction*, castor oil may be tried. In mild cases it will usually answer the desired purpose, as in the *costiveness of convalescence*, that of *pregnancy* and the *puerperal state*, and, generally speaking, in *that of young children;* but in the more obstinate cases, requiring more vigorous contraction of the bowel, it will often be necessary to have recourse to some more energetic cathartic. When there is a great mass of impacted feces, castor oil is generally inadequate to its removal. Here the hydragogue cathartics, especially the neutral salts, are more efficacious by promoting watery extravasation, and thus softening and breaking up the mass. Nor is castor oil generally well adapted to *habitual constipation;* not from any deficiency of power, but from the circumstance that few persons can take it habitually, without acquiring such a disgust for it, that it can no longer be borne on the stomach. There are, however, individuals who acquire a sort of relish for it, or at least can take it without the least aversion; and, in such persons, I have found it to answer well as a habitual laxative in small doses.

Diarrhœa of irritation is often completely relieved by a dose of castor oil with laudanum; the latter calming the irritation, while the former carries off the offending cause; and, in *mucous enteritis*, the same combination is very useful, at or near the commencement of the attack. So also in *irritated piles*, *prolapsus ani*, *stricture* and *organic affections of the rectum*, it is among the best cathartics for occasional use; though rarely supportable by the stomach when its very frequent repetition is required.

Mild cases of *dysentery*, treated at the very commencement with a full dose of castor oil, are sometimes cut short by it, and generally benefited; and, in severe cases, the oil may be given with advantage, either in connexion with calomel, or in a few hours after a dose of the mercurial. In the course, moreover, of the disease, an occasional dose of the oil often proves useful; and, in that irritated state of the bowels, in the advanced stage, in which, with little violence of inflammation, the patient is troubled with a constant desire to go to stool, with small and ineffectual evacuations, the *oleaginous mixture*, with a little laudanum, given in doses of half a fluidounce every hour or two, often answers an excellent purpose.

No cathartic is so appropriate in *typhoid or enteric fever*, when, as

not unfrequently happens, there is an indication for a gentle evacuation of the bowels. One fluidrachm will often operate kindly, and without the least annoyance to the patient; but if it should not be found to answer, the dose may be cautiously increased.

To the *summer complaint of children* the oil is well adapted, when tolerated by the stomach; and here, as in the advanced stages of dysentery, the oleaginous mixture, with a little laudanum, will often be found to answer well, when the pure oil might be rejected.

In *peritoneal inflammation*, also, when cathartics are indicated in order to remove feculent matter from the bowels, castor oil is usually the most appropriate.

In *irritated states* of the *bladder* and *genital apparatus*, it is among the best cathartics; but, when the affection amounts to inflammation with fever, the purgative salts are usually to be preferred.

Castor oil has been recommended for *tape-worm*, though of doubtful efficacy. It is not impossible, however, that, if taken very largely, it may injure the worm by involving it so as to prevent the access of air, and having thus weakened, may expel it by its purgative action. I have been informed of a case in which the long and free use of olive oil, followed by a dose of castor oil, resulted in the discharge of a portion of worm thirty feet long. (See my *Treatise on the Practice of Medicine*, 4th ed., i. 661.)

From its mildness and efficiency, castor oil is admirably adapted to infantile cases, of whatever kind, when simple evacuation of the bowels is indicated. It seems to be even less irritant to the stomach and bowels in children than in adults, and generally requires to be administered in a much larger relative dose. It is given in most of their complaints; magnesia only being preferred to it when there is excess of acid.

Administration. The full dose for an adult is a fluidounce, though half the quantity or even less will often operate. For infants it may vary from one to four fluidrachms. Seldom less than a fluidrachm is given to a child, more than three or four months old.

To infants it may often be given directly from the spoon. For older children and adults, the common method of administration is to introduce a little mint-water, or other aromatic water or infusion, into a wineglass, and, having moistened the inner surface of the glass, to pour in the oil, and cover it with more of the vehicle. The patient then takes it down at one or two swallows, and avoids the unpleasant and durable taste arising from its adhesion to the lips, tongue, &c. If the oil is previously warmed, so as to render

it thinner, it will be swallowed with still greater facility. Another method is to take it in a small cup of hot coffee, with cream and sugar. It may also be administered in a kind of emulsion with hot milk, or in the froth of porter when this is not contraindicated. These directions are not without importance; as the method of exhibition often determines whether the oil will be retained on the stomach or rejected.

An *oleaginous emulsion* may be made by taking a fluidounce of the oil, two drachms of powdered gum arabic, a drachm and a half of loaf sugar, and three fluidounces of mint-water; dissolving the gum and sugar in a little of the water so as to make a mucilage of about the same consistence with the oil, then rubbing the mucilage with the oil, and finally adding the remainder of the aromatic water. Any other aromatic liquid may be substituted for the mint-water, as diluted cinnamon water, strong fennel-seed tea, &c.; and the yolk of an egg may be substituted for the gum arabic. A tablespoonful of the mixture, containing a fluidrachm of the oil, may be given every hour, two, or three hours till it operates; or a larger quantity may be taken at once if required. In *dysenteric cases*, and *the bowel complaints of children*, it will often be found useful to add a little laudanum to each dose.

There are other fixed oils which have a laxative effect, and have sometimes been used for the purpose.

Olive Oil (*Oleum Olivæ*) has sometimes been substituted for castor oil, and has a somewhat similar effect, though much feebler. It must be given in double the quantity.

Linseed Oil (*Oleum Lini*) has similar properties; but is so disagreeable that it is seldom used.

Melted Butter has sometimes been used with advantage, as a laxative, in the advanced stages of dysentery, and in the same disease in a chronic state, in the dose of a tablespoonful every two hours. It is prepared by introducing the butter into a deep tin cup nearly filled with hot water, stirring for a time, and then allowing the mixture to stand. The butter having been melted by the heat of the water, by which also any salt that may have been mixed with it is dissolved, rises to the surface, and may be skimmed off as wanted.

All the above oils, including castor oil, are often administered by enema, in quantities varying, according as they are given with

other substances or alone, from one to four fluidounces. Thrown up in an unmixed state, they often prove serviceable, in cases of thread-worm infesting the rectum, by suffocating the little animal through the exclusion of air.

Castor oil is sometimes applied externally to the breasts of nursing women, to increase the secretion of milk. I can say nothing, from my own knowledge, in relation to its efficiency.

II. RHUBARB.

RHEUM. *U.S., Lond., Ed., Dub.*

Origin. Rhubarb is the prepared root of different species of Rheum, herbaceous perennial plants, natives of the interior of Asia, several of which have been introduced into Europe, where they are cultivated to a limited extent, especially in France and England. But the species which yields the only valuable rhubarb, that which is brought exclusively from central Asia, is wholly unknown. The drug has been conjecturally ascribed to *Rheum palmatum*, *R. undulatum*, *R. compactum*, and *R. australe*, all of which are said to grow wild in Tartary, and have been cultivated in Europe from seeds brought from Asia; and it is not impossible that one or more of these species may contribute to furnish the rhubarb of commerce; but we have no proof of the fact; and the failure to obtain from them a product, having the precise properties of the root as imported from the East, renders it extremely doubtful. The root of *R. palmatum* approaches nearest in character to the Asiatic rhubarb.

The leafstalks of the different species have an agreeable acidulous taste, owing to the presence of oxalic acid, and are used in making pies, tarts, &c., for which purpose the plants are cultivated in our gardens.

Rhubarb is collected and prepared in Chinese Tartary. After being dug up, the root is deprived of its smaller branches and cortical portion, cut into pieces of convenient size, and dried either in the sun, or with the aid of artificial heat. It is sent into commerce in two directions; one portion being taken eastward to Canton, and thence exported under the name of Chinese rhubarb; the other northwestward to St. Petersburg, whence it is distributed into commerce under the title of Russia or Turkey rhubarb; the latter name having originated in the circumstance, that it formerly reached the

markets of Europe through Turkey. As brought by these two routes, the drug differs considerably in quality, being prepared in a different manner, and possibly derived from different species, though of this latter fact we have no certain knowledge. Hence it is classed, both in commerce and pharmacy, in two varieties, which must be separately considered.

1. CHINESE RHUBARB.—*Rheum Sinense.* This is usually in cylindrical pieces, often somewhat flattened and irregular, of a brownish-yellow colour, and of an aspect as though the cortical part had been removed by grating or scraping. In each piece there is almost always a small hole, passing quite through it, and obviously intended for the insertion of a cord, by which it was probably hung up when dried, and portions of which may often be seen remaining in the opening. Though somewhat light and spongy, compared with many other roots, this variety is generally somewhat more heavy and compact than the Russian. When broken, it exhibits a rough uneven fracture, and a grayish-colour consisting of intermingled shades of brownish-red and white. By pulverization, it yields a yellow powder, tinged with reddish-brown, and portions of this powder, produced by attrition, are often seen on the outside of the pieces, giving them a yellow colour. Mixed with the better pieces, others often come, worm-eaten, more or less extensively decayed, or otherwise injured, so that the general character of a package is usually much inferior to that of selected portions; and, as the whole contents of a package are often powdered together, it happens that the pulverized Chinese rhubarb of the shops, even though genuine, is not unfrequently of low quality. It is, moreover, liable to adulteration with the rhapontic root, as it is called, an inferior variety of rhubarb cultivated in France.

A variety of rhubarb is sometimes imported from Canton, consisting of pieces, the surface of which has been trimmed so as to imitate the Russian; but close examination will generally detect in them the small perforating passage, or some remains of it, which has been mentioned as one of the characteristics of the proper Chinese rhubarb. It is, however, superior to the common unassorted variety, because selected from the soundest pieces.

2. RUSSIA RHUBARB.—*Turkey Rhubarb.—Rheum Russicum.—Rheum Turcicum.* As before stated, this comes from St. Petersburg, whither it is brought, through Siberia and European Russia, from the borders of Tartary. Before being permitted to enter the Russian dominions, it undergoes a rigid inspection, on which ac-

count, as well as from its inherent qualities, it is superior to the Chinese, and commands a much higher price in the market. The pieces are more irregular in shape than the former variety, and are distinguished by their somewhat angular surface, caused apparently by the successive cuts of a knife, in paring off the cortical portion. They are destitute of the small perforating passage of the Chinese variety, but generally have a larger hole, penetrating only to the centre, and clearly intended for the purpose of inspection. The pieces are lighter and less compact than the best Chinese, have usually a cleaner and brighter surface, and, when broken, exhibit a livelier hue, though of the same reddish-gray colour. The powder is of a fine bright yellow, without the reddish-brown tinge of the Chinese; and the odour is more aromatic.

General Properties. Rhubarb, in the state of powder, is bright yellow, or brownish-yellow, with a somewhat aromatic odour, and a bitter, astringent, and peculiar taste. When pieces of the root are chewed, they have a gritty feel under the teeth, and stain the saliva of a bright yellow. It yields its sensible properties of colour, taste, and odour, as well as its medical virtues, to water and alcohol. By heat odorous yellow fumes are given off, and the colouring property and bitterness are diminished, without an equal diminution of the astringency. The virtues of rhubarb are also diminished by long boiling.

Chief Constituents. Besides other less interesting ingredients, rhubarb contains *tannic and gallic acids*, *gum*, *starch*, *pectin*, *resinous matter*, *one or more colouring principles*, and a large proportion of *oxalate of lime*, to which it owes its white veins, and its grittiness under the teeth. Many attempts have been made to isolate its active purgative principle, but hitherto with imperfect success; for the various substances for which this title has been claimed, under the names of *caphopicrite*, *rhabarbarin*, *rhabarbaric acid*, *rheumin*, and *rhein*, have been shown to be more or less complex. There can be little doubt, I think, that the bitter and cathartic principle is the same, for rhubarb is purgative in proportion to its bitterness; and as little doubt that it is driven off at an elevated temperature; for the purgative property is diminished by much or long continued heat, while yellow and odorous fumes escape. The astringency of rhubarb is owing to its tannic acid.

Effects on the System. Rhubarb combines purgative with tonic and astringent properties. In very small doses, insufficient to operate on the bowels, it acts like the simple bitters, increasing the

appetite, and promoting digestion, and is thought to exercise a somewhat astringent power, shown in the checking of mild diarrhœa. With a little increase, however, of the dose, it becomes laxative, and I have often known Russia rhubarb to act gently on the bowels, producing one soft feculent discharge, in the dose of three grains. In larger doses it is actively purgative, operating probably in chief, if not exclusively, upon the peristaltic motion, and evacuating the liquid contents of the upper bowels, along with the more concrete matter of the colon and rectum. There is no reason to believe that it promotes, to any considerable extent, secretion or extravasation into the bowels. Though it produces not unfrequently more or less griping, this probably arises from the energy of its action on the muscular coat, and not from any direct irritation of the alimentary mucous membrane. It does not appear to be capable, in any dose, of producing serious inflammation of this membrane; in this respect differing strikingly from the drastic cathartics. The stools are coloured by it of a deep brownish-yellow. It is rather slow in producing its purgative effect, and is thought to leave behind a disposition to costiveness, which is attributed to the tannic acid contained in it.

It is doubtful whether rhubarb acts on the muscular coat through an original impression upon the inner surface, or by means of absorption. That its colouring matter, at least, is taken into the circulation, is sufficiently proved by its imparting a yellow colour to the urine, and, as has been asserted, to the perspiration also, especially that of the axilla. If it be true, as stated by writers, that it has produced a purgative effect when sprinkled over the surface of large ulcers, and that the milk of nursing women who have taken it operates on the bowels of the infant, it must be admitted that its purgative principle also is absorbed; and that it may possibly produce its ordinary cathartic effect through the channel of the circulation.

In its influence on the system at large, rhubarb is supposed by some to be gently excitant, somewhat increasing the pulse and general warmth, especially when administered during the existence of a febrile condition. There is no reason whatever to believe that it has any special action on the liver, as was at one time supposed.

Therapeutic Application. Rhubarb was known as a medicine so early as the times of the Emperor Justinian, and probably long before. Its practical uses are such as might be inferred from the account above given of its properties. Whenever an indication for the

evacuation of the bowels is conjoined with a debilitated state of the digestive organs, or considerable general debility, rhubarb may be used with propriety, especially if, at the same time, it should be desirable that no disposition to looseness be left behind.

It is the laxative beyond all others adapted to the *constipation of dyspepsia.* While it gently opens the bowels, it tends rather to invigorate than further to weaken digestion, and, though followed, after each operation, for a time, by a tendency to costiveness, it does not appear to exhaust the susceptibility to its influence, or at all events, does so very slowly; for I have known patients to use it habitually as a laxative for many years, without being under the necessity of materially increasing the dose. Upon the whole, it appears to me to be the best substitute in our possession for the normal influences which sustain regular alvine evacuations, and to maintain a condition of the alimentary canal nearest to that of health. In cases of habitual constipation, the best period, I think, for administering it, is at bedtime, so that it may operate in the morning. It is very frequently associated in dyspepsia with a little blue mass, when the liver, as often happens, is torpid; and, if there is peculiar insusceptibility of the lower bowels, it may be advantageously combined with aloes.

In *diarrhœa*, when there is an indication for cathartic effect, rhubarb often answers well from the self-limiting property already referred to, as also for the somewhat astringent effect of its tannic acid, to which indeed that property may be reasonably ascribed. It is often combined with magnesia, when there is acidity in excess. To cases in which there is high irritation or inflammation of the alimentary mucous membrane, it is not so well adapted, and, in such cases, should give way to castor oil. It appears to prove especially useful in the *bowel complaints of infants*, in which it is much used.

There is sometimes occasion for a cathartic effect, in *chronic dysentery*, in order to keep the upper bowels free. In such cases, rhubarb may be chosen, when the state of system is so much debilitated as to require support instead of depletion.

In the advanced stages of most *febrile diseases of a typhous or malignant character*, rhubarb often operates most usefully, removing the irritant or depressing feculent matter, without in any degree debilitating, but, on the contrary, rather strengthening the patient.

So also in *scrofulous diseases*, *atonic gout*, *old paralytic affections*, and, indeed, all complaints of debility, rhubarb may be employed

with propriety, whether habitually or occasionally, as the case may require.

It is *contraindicated* in acute febrile and inflammatory affections, with a sthenic state of system; though, combined with calomel, it seems to lose in some measure its peculiarities, and acts with much energy. A dose of calomel and rhubarb is not unfrequently administered, with good effect, at the commencement of bilious fevers, and other acute affections involving the liver.

As a *local remedy*, rhubarb has been applied to indolent ulcers, being sprinkled in the form of powder over the surface.

Administration. The dose of rhubarb as a laxative is from three to ten grains. Five grains of good Russia rhubarb will generally operate decidedly in this way; and the best Chinese is but little inferior. For full purgative effect, the dose is from fifteen to thirty grains. More, however, is often required of the inferior powdered rhubarb, frequently found in the market. By roasting the root, its purgative effect is diminished, and the astringency relatively increased.

Rhubarb may be given either in powder, pill, infusion, tincture, syrup, or extract. In whatever form administered, it may be advantageously combined with an aromatic, in order to correct its occasional griping effect. Under ordinary circumstances, when it is given as a laxative, the pilular form is most convenient.

A *Compound Powder of Rhubarb* (PULVIS RHEI COMPOSITUS, *Ed.*, *Dub.*) is directed by the Edinburgh and Dublin Colleges, consisting of two parts of rhubarb, six of magnesia, and one of powdered ginger, of which the dose is from thirty grains to a drachm, or five to ten grains for a child. It is given in bowel complaints, when an antacid laxative is indicated.

The officinal *Pills of Rhubarb* (PILULÆ RHEI COMPOSITÆ, *U.S.*) are made with rhubarb and a third of its weight of soap; and each pill contains three grains of the root. The soap is intended to render the pill more soluble. I have found, however, that rhubarb pills made simply with a little tincture of cardamom, while they have the advantage of the least possible bulk, operate well, and retain their power unabated for a long time. As a laxative, given at bedtime, its slowness of operation is no disadvantage. When it is desired that the medicine should act as quickly as possible, it should be given in another form.

The *Compound Rhubarb Pills* (PILULÆ RHEI COMPOSITÆ, *U.S.*) contain rhubarb, aloes, and myrrh, with a little oil of peppermint,

and may be employed when a warming, tonic laxative is wanted, as in dyspepsia with costiveness, and there is no hemorrhoidal affection or tendency towards it. From one to four pills, or from five to twenty grains of the mass may be taken for a dose; the smallest quantity being used at first, when a simple laxative effect is wanted, and increased if necessary.

The officinal *Infusion of Rhubarb* (INFUSUM RHEI, *U. S.*) is made by macerating a drachm of the bruised root, for two hours, in half a pint of boiling water. The dose is one or two fluidounces, which may be repeated at intervals of three or four hours till it operates. Advantage would often accrue from adding half a drachm of nutmeg or cardamom, or a drachm of fennel-seed to the rhubarb, in preparing the infusion, especially in cases of irritable stomach.

There are several officinal tinctures.

Tincture of Rhubarb (TINCTURA RHEI, *U. S.*) contains only rhubarb and cardamom, and may be used, in preference to the other forms, in low states of fever, as in typhus fever, for example, when a conjoint stimulant and laxative effect is wanted.

Compound Tincture of Rhubarb (TINCTURA RHEI COMPOSITA, *Lond.*, *Dub.*) does not materially differ from the above.

Tincture of Rhubarb and Aloes (TINCTURA RHEI ET ALOES, *U. S.*, *Ed.*), sometimes called *elixir sacrum* or *sacred elixir*, differs from the simple tincture only in containing aloes, and may be preferred in the more inert state of the bowels, and especially when costiveness is conjoined with amenorrhœa.

Tincture of Rhubarb and Gentian (TINCTURA RHEI ET GENTIANÆ, *U. S.*, *Ed.*) combines the virtues of a simple bitter with those of a laxative.

Either of the above tinctures may be used, when a conjoint stomachic and laxative effect is desired, in cases admitting or requiring moderate stimulation. They are especially adapted to low states of the system, and to individuals who have been accustomed to the use of stimulant drinks. They are, however, chiefly employed as adjuvants to other preparations; being added to the solutions of the saline cathartics, tonic or laxative infusions, and various mixtures, when a warming or cordial impression on the stomach is desired. One may be selected in preference to another, according to the indications which may be offered. The dose as mere stomachic laxatives is from one to four fluidrachms, as purgatives from half a fluidounce to a fluidounce.

Tincture of Rhubarb and Senna (TINCTURA RHEI ET SENNÆ, *U. S.*) has been officinally adopted from popular usage. It is the prepara-

tion commonly known as *Warner's gout cordial*, and contains, in addition to the cathartics mentioned in its title, other ingredients intended simply to give it colour, improve its taste, and render it more acceptable to the stomach. It is a feeble laxative, and may be given as such in chronic gouty cases, or others in which the susceptibility of the stomach has been impaired by indulgence in the use of alcoholic drinks. It is wholly unsuited to an unimpaired condition of the stomach; being much too stimulant in proportion to its purgative power. The dose is from half a fluidounce to two fluidounces.

There is an officinal *Wine of Rhubarb* (VINUM RHEI, *U. S.*) prepared from rhubarb and canella, which may be used as a cordial laxative in the dose of from one to four fluidrachms.

Two syrups are recognized by the U. S. Pharmacopœia, the simple and aromatic.

Syrup of Rhubarb (SYRUPUS RHEI, *U. S.*) is prepared by first forming a tincture, then evaporating the alcohol, and incorporating the residue with sugar. It is a mild cathartic, adapted especially for infants, to whom it is given in the dose of one or two fluidrachms.

Aromatic Syrup of Rhubarb (SYRUPUS RHEI AROMATICUS, *U. S.*) differs from the preceding, in containing, besides the rhubarb, some of the finer aromatics, namely, cloves, cinnamon, and nutmeg. It is an elegant preparation, admirably adapted to infantile diarrhœa, when there is no inflammation of the mucous membrane, or all acute symptoms have passed. It was much used popularly in this country, in the common summer complaint of children, under the name of *spiced rhubarb*, before being admitted into the Pharmacopœia. The dose of it is a fluidrachm for an infant, repeated every two hours till it operates. The yellow colour it imparts to the stools may be received as an evidence of its operation, in cases of diarrhœa. A little magnesia may often be combined with it advantageously.

Extract of Rhubarb (EXTRACTUM RHEI, *U. S.*) is prepared by first forming a tincture with diluted alcohol, and then evaporating by means of a water-bath. If properly prepared, it has the virtues of rhubarb in a concentrated state; and if made from good rhubarb, should operate in doses about two-thirds that of the root itself.

Fluid Extract of Rhubarb (EXTRACTUM RHEI FLUIDUM, *U. S.*) is a preparation peculiar to the U. S. Pharmacopœia. It is made by first exhausting the root with diluted alcohol, then concentrating carefully by means of a water-bath, and, when the fluid has been sufficiently reduced, adding the oils of anise and fennel dissolved in the tincture of ginger. It is an elegant preparation, containing

the virtues of rhubarb in a concentrated liquid form, and qualified by aromatics. The full dose of it, if well prepared, from good rhubarb, should be half a fluidrachm for an adult, and from four to six minims for a child two years old; at all events, in reference to any particular parcel, it would be well not to exceed these doses until its activity has been tested by trial.

European Rhubarb. I have said little upon the subject of this variety of rhubarb, because its use should, I think, not be encouraged. It is less bitter and purgative, and relatively more astringent than the Asiatic rhubarb; and requires to be given in twice the dose, in order to produce the same effect. The consequences of introducing it into general use would be, to render the dose of rhubarb uncertain, and to lead almost inevitably to the adulteration of the finer kinds, for which I have understood that it is even now considerably used.

III. BUTTERNUT.

JUGLANS. *U. S.*

Under the name of *Juglans* or *Butternut*, the U. S. Pharmacopœia recognizes the inner bark of the root of the *Juglans cinerea*, or common *white walnut tree* of this country, which grows in Canada, and through the northern portions of the United States. When first taken from the tree, it is white, but soon changes colour, becoming at first yellow, and ultimately of a dark walnut-brown. A decoction of the bark is purgative; but it is the extract that is almost exclusively employed.

Extract of Butternut (Extractum Juglandis, *U. S.*) is directed, in the U. S. Pharmacopœia, to be prepared by evaporating an infusion of the bark, which is preferably made by the process of displacement. Care should be taken not to carry the heat too far. The extract would probably be more effective if diluted alcohol, instead of water, were employed as the menstruum. It is hard and brittle, of a black colour, a sweetish, not unpleasant smell, and a bitter, somewhat astringent taste. The greater part of it is soluble in water.

It is a mild cathartic, said to resemble rhubarb in its mode of operation, and applicable to similar purposes. It was employed to

a considerable extent, during our revolutionary war, by Dr. Rush and others connected with the military service of the country, when the scarcity of rhubarb induced them to search for a substitute for that cathartic. It may be used as a laxative in the dose of from five to ten grains, as a purgative from twenty to thirty.

IV. ALOES.

ALOE. *U.S.*

Origin. All the aloes of commerce is derived from plants belonging to the genus *Aloe*, the leaves of which, on being wounded, yield a bitter purgative juice. The more prominent species from which the drug is derived are *Aloe spicata* growing at the Cape of Good Hope, *Aloe Socotrina* inhabiting the island of Socotra, and probably the neighbouring coasts of Africa and Arabia, and *Aloe vulgaris*, a native of the South of Europe and North of Africa, and cultivated largely in the West Indies, particularly in the Island of Barbadoes. Other species contribute to the aloes of commerce, but have attracted less notice than those mentioned. All the species are perennial, with fleshy and succulent leaves, the purgative juice of which is contained in passages underneath the epidermis, and flows out when the leaves are cut transversely. The parenchyma of the leaf yields on pressure a mucilaginous juice, which has little of the cathartic property.

Aloes is obtained from the plants by processes somewhat different, and varies in its quality according to the particular method followed. The best is prepared by cutting off the leaves, receiving the juice which exudes in a convenient receptacle, and then allowing it to evaporate in the sun. Another method, which affords also a good product, though somewhat inferior, is to inspissate the juice, collected as just mentioned, by artificial heat. A third plan is to bruise the leaves, express the juice, and boil it down to the proper consistence; and a fourth, simply to make a decoction with the comminuted leaves, and, having separated the undissolved matter, to concentrate by boiling as just mentioned. The last two methods yield the drug of inferior quality, and the fourth method is the worst of all.

There are several varieties of the drug, each characterized by peculiar qualities, and derived from a peculiar source. Of these it is necessary to mention here only the Cape aloes, the Socotrine, the hepatic, and the Barbadoes. They are brought into market, sometimes in skins, sometimes in chests, kegs, or barrels, and sometimes

in gourds; but, as kept in the shops, they are usually broken into fragments altogether irregular in size and form.

1. CAPE ALOES. This, which has been very largely consumed in the United States, and, when pure, is an excellent variety of the drug, received its name from the Cape of Good Hope, where it is prepared. It is said to be procured from different species of Aloe, of which, however, *A. spicata* probably yields it most abundantly. The juice, which flows from the leaves when cut, is boiled to the due consistence, and hardens on cooling. It is characterized by its dark-olive or greenish-black colour, its smooth and very glossy surface when broken, its translucency at the edges, and the fine bright yellow colour of its powder, which is slightly tinged with green. The pieces are often more or less covered with this yellow powder, which tends to conceal their proper colour in mass. Small fragments are occasionally found in the packages which are almost transparent, and give a yellow or reddish tinge to transmitted light; and it is said that some parcels from the Cape have had a yellowish-brown colour like that of Socotrine aloes, which is very possible; as the drug is derived from different species. When perfectly solid it has little or no smell; but, when the powder is received into the nostrils, it produces, in minute quantity, an intense impression, which can scarcely be distinguished from the sense of bitterness which it also impresses on the palate. In hot weather the pieces are often soft, especially when recent; but they are hard and brittle when cold, and become so at all temperatures by time.

2. SOCOTRINE ALOES.—*Aloe Socotrina.* Lond.—*Aloe Socotorina.* Ed. This variety of aloes has been long known and most esteemed. It derives its name from the Island of Socotra, in the Straits of Babelmandel, where it is produced; but it is highly probable that much of the drug, sold by this name, is obtained also from the neighbouring coast of Africa. It is supposed to be collected from *A. Socotrina;* the juice being allowed to inspissate in the sun. The pieces are of a yellowish-brown or reddish-brown colour, considerably resembling that of the liver. Not unfrequently the outside of the pieces is reddish-brown, while the interior is yellowish, and portions at first light-coloured become darker by exposure. Its fractured surface is shining, though less so than that of the preceding variety. The edges are translucent. It has an agreeable aromatic odour, which is quite peculiar; and its powder, which is of a beautiful golden yellow colour, affects the nostrils in the same

manner as that of the Cape aloes. Like that variety, it is apt to be soft when fresh, and especially in the interior of the masses, but hardens by time and exposure.

3. HEPATIC ALOES.—*Aloe Hepatica.* Lond., Dub.—*Aloe Indica.* Ed. Hepatic aloes derives its name from the resemblance of its colour to that of the liver. But, in this respect, it differs little from the darker-coloured portions of the Socotrine. It is brought from the East Indies, especially Bombay, whither it is taken from the coast of Arabia, and probably of Africa. It may possibly be obtained from the same species as the Socotrine, and differ from that variety simply from its less careful preparation; but nothing is known positively upon these points. It is of a reddish-brown colour, sometimes very dark, less shining than the preceding varieties, quite opaque at the edges, and of a disagreeable instead of aromatic odour. The colour of the powder is a dull-yellow. This variety often contains impurities.

4. BARBADOES ALOES.—*Aloe Barbadensis.* Lond., Ed. This derives its name from the Island of Barbadoes, where it is most largely produced, though collected also in Jamaica, and perhaps other W. India Islands. It is said to be obtained mainly from *Aloe vulgaris*, which is cultivated for the sake of it. Either the juice of the leaves, or a decoction obtained by boiling them, finely chopped, and suspended in nets or baskets in water, is evaporated sufficiently, and then poured into large gourds to harden. This variety is of a dark-brown or reddish-brown colour, of different shades, of a dull fracture, perfectly opaque at the edges, and of a disagreeable nauseous odour. The colour of the powder is a dull yellow, with a tinge of olive. It is said to be the strongest in cathartic power, and is much used as a purgative for horses.

Under the name of *fetid*, *caballine*, or *horse* aloes, inferior varieties of the drug have been brought into commerce from various sources; but, not being used in medicine, they need not be described here.

Sensible and Chemical Properties. All the varieties of aloes are extremely and disagreeably bitter, and all, in powder, produce the peculiar impression on the nostrils before referred to under Cape aloes. Their other sensible properties have been already sufficiently described. Heated in the open air, aloes takes fire, and gives out while burning thick fumes, which have the odour of the drug. It imparts a dark yellowish-brown colour, with its bitter taste and medical virtues, to water and alcohol. It consists of a portion soluble in cold water, and of another insoluble, in the former of which the

sensible and medicinal properties of the drug reside. Alcohol and boiling water dissolve nearly the whole; but the latter deposits a large proportion on cooling. It has been ascertained that, at an elevated temperature, and exposed to the air, the soluble portion in solution attracts oxygen from the atmosphere, and becomes insoluble and inert. Hence, the longer the juice of the plant is exposed to heat in its inspissation, the weaker it becomes; and hence, too, the impropriety of exposing aloes long to a boiling temperature in its pharmaceutical treatment. The proportion of this soluble matter differs very much in different varieties of the drug, but is greatest in the Socotrine, of which the finest specimens have yielded as much as 85 per cent. From this proportion it diminishes, in the inferior kinds, down to about 50 per cent. The portion soluble in cold water and alcohol has been called *extractive* matter; that soluble only in alcohol or boiling water, *resin* or more properly *apotheme;* and, besides these, there is said to be a proportion of albumen. Volatile oil has been found in Socotrine aloes. The alkalies, their carbonates, and soap render the insoluble part more soluble in water. The infusion of galls yields a copious precipitate with an infusion of aloes, and is therefore incompatible.

Active Principle. The soluble matter above referred to, under the name of *extractive*, contains, but is not itself the pure active principle. M. Edmund Robiquet supposed that he had isolated this principle, and gave it the name of *aloesin.* But subsequent investigation has shown that this was not pure. Messrs. T. and H. Smith, of Edinburgh, have succeeded in completely isolating the active principle, and obtaining it in a crystalline state. They have named it *aloin.* For the mode of procuring it, the reader is referred to the article Aloes, in the U.S. Dispensatory (10th ed., p. 74.) *Aloin* is a neuter substance, in pale yellow crystals, at first sweetish but soon becoming intensely bitter to the taste, combustible without residue, somewhat soluble in cold water and alcohol but more so in those liquids when hot, rendered more soluble by the alkalies, and rapidly oxidized in a heated solution exposed to the air. It is precipitated by a strong solution of the subacetate of lead, in combination with the oxide. It operates as a cathartic in the dose of one or two grains, and sometimes in so small a dose as half a grain.

Effects on the System. Aloes is a warming somewhat stimulant cathartic, with a disposition to act preferably on the large intestines, very slow in its operation, and possessing, in addition to its purgative properties, those of a tonic, hepatic stimulant, and emmena-

gogue. In the dose of a grain or two, repeated two or three times a day, it generally produces one or more evacuations in the twenty-four hours, and exercises a tonic influence on the digestive organs, more particularly exhibited in debilitated states of the stomach. If continued long, it evinces a tendency to irritate the rectum, and, indeed, to cause a congested state of the pelvic viscera generally, which gives rise to tenesmus, feelings of heat, weight, or uneasiness in the parts sometimes extending to the lower limbs, and occasionally excitation of the sexual organs, a disposition to micturate frequently, and with women an increase of the menstrual function. In full doses, it acts vigorously as a cathartic, and generally produces more or less of the above mentioned effects in the pelvic region, especially heat and irritation of the rectum, though, in the great majority of cases, not to any painful extent. At the same time, it increases somewhat the frequency of the pulse, and the general warmth. The cathartic effect is seldom produced before six hours after the dose has been taken, frequently not until from eight to twelve hours, and sometimes even after twenty-four. The discharges are feculent, and generally more or less consistent; as it is the contents of the lower bowels that are evacuated. Little or no increase of cathartic effect can be obtained by a further increase of the dose; as nothing is left in the lower colon and rectum to be discharged, and the purgative action of the medicine does not extend to the upper bowels: but the irritation of the pelvic viscera is augmented in proportion to the quantity taken. The operation would seem to be directed mainly to the peristaltic function; as the secretions of the bowels are not materially increased. It is asserted, however, by some, that the hepatic secretory function is excited, and bile produced more copiously than in health.

Mode of Operation. There can, I think, be little doubt that aloes is absorbed, and produces its peculiar effects mainly through the circulation. Thus, it has been asserted that, when given as an enema, it does not, like most irritants in the same situation, produce a speedy evacuation of the bowels; but acts as slowly, and in the same manner, as when taken by the mouth. This could not happen, if, in its ordinary method of operation, it affected the rectum only upon reaching it with the contents of the bowels. But still stronger proof is afforded by the well attested fact, that, when sprinkled on blistered surfaces deprived of the cuticle, it acts after the same interval of time, upon the same portion of the bowels, and, so far as can be appreciated, in the same manner, as when swallowed. This

could only happen through its absorption. It seems, then, when taken into the circulation, to be capable of moderately exciting the heart and arteries, increasing the action of the liver, and specially stimulating the whole pelvic viscera.

Therapeutic Application. Aloes was used as a purgative by the ancient Greek and Roman physicians, and is among those most employed by the moderns. It is indeed a highly important remedy, producing effects which, taken together, can be obtained from no other single medicine. The indications which it would seem calculated to fulfil are to evacuate the contents of the lower bowels, without weakening the patient; to stimulate the digestive function when impaired; to excite the torpid liver; to direct blood and nervous energy to the rectum and lower colon, the urinary and genital organs in the pelvis, and especially the uterus; and to act as a gentle warming stimulus to the system generally.

It is an admirable laxative in *habitual costiveness*, dependent on an inirritable state of the colon and rectum, and especially when associated with want of due hepatic action. If *dyspepsia* or torpor of stomach coexists with the other symptoms, the indication is still stronger. In these cases, it is much used, either alone, or associated with rhubarb. It should usually be employed in small doses, and given either at bedtime, or about an hour before a meal, especially before dinner. It usually operates on the following day, producing one easy evacuation.

If, to the above indications, that afforded by the existence of amenorrhœa is added, aloes is perhaps the most efficient remedy to which we can have recourse. Of its emmenagogue operation, however, I shall have occasion to treat in another place.

In *jaundice*, aloes sometimes operates with great effect. Perhaps it may not be so efficient, as a general rule, in restoring the action of the liver in this disease, as the mercurials; but it will sometimes prove even more successful; and I have known jaundice, which had obstinately resisted calomel and other remedies, yield promptly to active aloetic purgation. It is proper, in this affection, not to depend on small laxative doses, but to administer the full purgative dose at once. It probably proves useful, not only by a direct influence on the liver, but by stimulating the stomach and duodenum, and thus secondarily operating on that organ.

Another special application of aloes is to the treatment of *chronic splenitis*, in which it operates favourably by a revulsive influence upon the lower bowels, situated at the further extremity of the

portal circulation, with which the spleen also is connected. It is probably among the most efficient remedies in enlargements of the spleen, dependent on a sustained irritative action in that organ.

It may also be used in all cases, in which serious disease in any organ or part of the body may be supposed to depend on *checked hemorrhoidal discharge*, the *cure of hemorrhoidal tumours*, or the *healing of fistulous ulcers near the anus*. The indication is here to induce a return of the rectal affection; and nothing is so efficient for this purpose as aloes, which, under these circumstances, should be given in large doses, so as to act promptly, or in small and repeated doses, according as the complaint to be relieved is acute or chronic. *Hepatic* and *splenic disease*, *hemorrhage or other disease of the lungs*, *congestion of the brain*, *apoplexy*, *hemiplegia*, and *insanity* are among the affections which may sometimes be advantageously treated in this way. Even when there has been no antecedent disease of the rectum, a strong direction of the blood and nervous power to the pelvic viscera, such as aloes is capable of producing, may prove useful, on the principle of revulsion, in cephalic and pectoral diseases. Esquirol found advantage from this therapeutic measure in the treatment of certain cases of insanity; and it might sometimes be used advantageously, as a prophylactic measure, in cases where a strong tendency to pulmonary tuberculosis is suspected, especially in young women in whom the menstrual function has not been established, or may have been suppressed.

Aloes has also been employed as a *vermifuge*, under the supposition that, through its intense bitterness, it might prove noxious or poisonous to the worms. But it has been of little or no service, except in the case of *ascarides*, upon which it can be brought to bear very effectually by injection into the rectum.

Besides the above special uses, aloes is also very frequently employed as an ingredient of *compound purgative preparations*, in which it answers a useful purpose by adding its peculiar mode and seat of action to those of the other cathartics used, and thus increasing their purgative effect, while their disposition to irritate is lessened, according to principles explained under the general head of cathartics. Thus, it enters into the composition of the *compound extract of colocynth*, the *compound pills of gamboge* of the London Pharmacopœia, and our own officinal *compound cathartic pills*.

The *contraindications* to the use of aloes are the existence of acute febrile inflammation, and a sthenic state of idiopathic fever, acute inflammation of the rectum, colon, bladder, uterus, or other parts

of the genital apparatus, and hemorrhoidal disease, or a strong tendency towards it. Very frequently, during its administration in habitual costiveness, amenorrhœa, &c., considerable irritation of the rectum comes on; or an old tendency to hemorrhoidal disease is renewed; or the womb, already perhaps phlogosed, becomes the seat of a high irritative action, or of hemorrhage. In such cases, the medicine must be suspended, unless the induced condition may itself be a part of the curative agency in the case. Aloes should not be given to pregnant women, when there is any reason to fear the production of abortion from pelvic irritation. But, in that debilitated state of the organs seated in the pelvis, which sometimes attends long continued chronic inflammation, it has occasionally proved serviceable, as in piles with relaxation.

Administration. The laxative dose of aloes is from two to six grains, the full purgative dose from ten to twenty grains. It is most agreeably given in the form of pill. As the alkalies, alkaline carbonates, and soap are thought, by rendering aloes more soluble, and otherwise qualifying its condition, to obviate in some measure its tendency to irritate the rectum, it is customary to use soap in the preparation of the pills.

The officinal *Aloetic Pills* (PILULÆ ALOËS, *U. S.*) are made of equal parts of aloes and soap; and each pill weighs four grains. One, two, or three of them may be given for laxative effect, and five as a full purgative.

There are several compound officinal pills containing aloes as their chief ingredient.

Pills of Aloes and Assafetida (PILULÆ ALOËS ET ASSAFŒTIDÆ, *U. S.*) consist of the two ingredients mentioned in the name, made into a pilular mass with soap. They are adapted to costiveness, with debility of stomach, and a great tendency to flatulence. Each pill contains four grains of the mass, and its three constituents are in equal proportion.

Pills of Aloes and Myrrh (PILULÆ ALOËS ET MYRRHÆ, *U.S.*), or *Rufus's pills*, as they have been long called, consist of aloes, with half its weight of myrrh and a little saffron, made into a pilular mass with syrup. They are used specially in constipation with amenorrhœa. Each pill contains about two grains of aloes, by the quantity of which the dose is to be regulated.

There are also other officinal pills, as the *Compound Pills of Aloes* (PILULÆ ALOËS COMPOSITÆ) of the London and Dublin Pharmacopœias, and the *Pills of Aloes and Iron* (PILULÆ ALOËS ET FERRI, *Ed.*),

the former containing chiefly aloes and extract of gentian, the latter aloes and sulphate of iron; both, no doubt, excellent combinations, but so readily suggesting themselves to the mind of the practitioner, that they might very well be left to extemporaneous prescription.

There are two officinal powders containing aloes; one the *Powder of Aloes and Canella* (PULVIS ALOËS ET CANELLÆ, *U. S.*), or the *hiera picra* of older pharmacy, containing four parts of aloes mixed with one of canella; the other the *Compound Powder of Aloes* (PULVIS ALOËS COMPOSITUS, *Lond.*) which consists of three parts of aloes, two of guaiacum, and one of aromatic powder rubbed together. The aromatic in these powders serves to obviate any griping tendency of the aloes, and the guaiac in the London preparation renders it somewhat more warming and stimulant to the stomach. But, in consequence of the excessive bitterness of aloes, neither of these is an eligible form for administering it.

A *Compound Decoction of Aloes* (DECOCTUM ALOËS COMPOSITUM, *Lond.*) is directed by the British Pharmacopœias. It is prepared by boiling aloes, myrrh, liquorice, saffron, and carbonate of potassa with water, and adding compound tincture of cardamom. The boiling diminishes the purgative property of the aloes, while the alkaline carbonate renders it more soluble, and, as some think, also milder. The aromatics render it more acceptable to the stomach, and the myrrh adds to its tonic and perhaps emmenagogue properties. It is, however, little used in this country. The dose is from four fluidrachms to a fluidounce. The formula is contained in the U. S. Dispensatory.

Tincture of Aloes (TINCTURA ALOËS, *U. S.*) consists of aloes and liquorice, dissolved in a menstruum composed of one part by measure of officinal alcohol and three of water. The liquorice is added to cover the taste of the aloes, which it does but very imperfectly. An advantage of the preparation is the weakness of the spirituous menstruum, which only contains about sufficient alcohol to enable it to keep well. As a full purgative, the dose of the tincture is from half a fluidounce to a fluidounce; as a laxative from one to three fluidrachms.

Tincture of Rhubarb and Aloes (TINCTURA RHEI ET ALOËS, *U. S.*) has already been referred to. (See *Rhubarb*, page 492.)

Tincture of Aloes and Myrrh (TINCTURA ALOËS ET MYRRHÆ, *U. S.*), which is made with aloes, saffron, and tincture of myrrh, is a modification of the old *elixir proprietatis*, and is occasionally used as a warming, laxative, tonic emmenagogue, in chlorotic females with constipation and amenorrhœa, in the dose of one or two fluidrachms.

Aloes enters also into the *Compound Tincture of Benzoin*, which will be referred to again under the balsams.

Wine of Aloes (VINUM ALOËS, *U. S.*) is retained by the U. S., Lond., and Ed. Pharmacopœias, though it scarcely seems necessary to have two preparations so analogous as this and the *Tincture of Aloes*. The wine, however, differs from the tincture in having cardamom and ginger, as adjuvants or corrigents of the aloes, instead of liquorice. The dose is about one-half that of the tincture.

Extract of Aloes (EXTRACTUM ALOËS, *Lond.*) is directed by the London and Dublin Colleges. It is prepared by evaporating a watery solution of the soluble parts of aloes; but, considering the injury which aloes undergoes in the preparation, it is very doubtful whether the resulting extract is either stronger or more certain than the drug itself.

V. SENNA. *U.S., Dub.*

Origin. Senna consists of the leaflets of several species of *Cassia*, among which those which yield it most largely are *C. acutifolia* of Upper Egypt and Nubia, *C. obovata* of Lower Egypt, Syria, &c., *C. elongata* of the South of Arabia, cultivated in India, and *C. Æthiopica*, growing in Fezzan, southward of Tripoli, on the African coast of the Mediterranean. *C. lanceolata* of Forskhall, growing in Arabia in the neighbourhood of Mecca, probably also yields it. All these species are small shrubs, with pinnate leaves, and leaflets characterized by the obliquity of their base; the angle which the edge of the leaf forms with the midrib at its insertion being different on the two sides. With the leaflets are not unfrequently also gathered portions of the footstalks of the leaves, the flowers, and the fruit, the last of which is a flat membranous legume or pod, in some species curved, and in others nearly straight. There are several commercial varieties of the drug, named from the place of their export or production. The following are brief notices of those in common use.

1. ALEXANDRIA SENNA (*Senna Alexandrina*, Lond., Ed.), so named from the Egyptian port whence it is commercially distributed, is collected mainly in Nubia and Upper Egypt, from the *Cassia acutifolia*, and brought down to Boulac on the Nile, in the neighbourhood of Cairo. Here it formerly underwent admixture with certain proportions of the leaflets of the *Cassia obovata*, growing in Lower Egypt, and the leaves of *Cynanchum oleæfolium*, commonly called

argel; and, thus prepared, was repacked, and sent down the Nile to Alexandria. At present, however, these additions are not always, if ever made; and the Alexandria senna now imported generally contains little or none of the argel, and but a comparatively few leaflets of C. obovata. It consists, therefore, mainly of the leaflets of C. acutifolia, with small portions of the footstalks, flowers, pods, &c. These leaflets are almost always less than an inch long, somewhat ovate, and pointed at the end. Those of *argel*, which are still occasionally to be found among them, are distinguishable by their regular base, that of the senna leaflets being as before stated always oblique, by their much greater length, usually exceeding an inch, their lighter colour, firmer texture, and the nearly total absence of lateral veins. The leaflets of the obovate senna, are at a glance distinguishable by their more rounded form, their greatest breadth near the upper end, and their mucronate point. This variety of senna is most highly esteemed.

2. Tripoli Senna derives its name from the Barbary port of Tripoli, whither it is brought by caravans from Fezzan. It consists, in general, exclusively of the product of one species of Cassia, which is believed to be the *C. Æthiopica* of Guibourt, the leaflets of which closely resemble those of *C. acutifolia*, though perhaps somewhat smaller and more fragile; and this variety of the drug is characterized chiefly by the great extent to which the leaflets are broken up. It is probably not less efficient than the Alexandria senna, but is less esteemed in consequence of this comminuted state of the leaflet. It is very seldom brought into the United States.

3. India Senna (*Senna Indica*, Lond., Ed.), though brought from the ports of Hindostan, is mainly produced in the southern parts of Arabia, whence it is taken in the native vessels to Bombay. It is sometimes called *Mocha senna*, from the Arabian port of that name. It is the product exclusively of the *Cassia elongata*. This plant has, within a few years, been introduced into India, and cultivated to a considerable extent. A sub-variety of the drug thus produced is called *Tinnevelly senna*. India senna is distinguished by the great relative length of the leaflets, from one to nearly two inches, and their oblong shape. As ordinarily found in the shops, it has a yellowish hue, and is frequently intermingled with leaves decayed or otherwise injured. It has considerable activity; but is thought to be somewhat inferior in this respect to the Alexandria senna. The Tinnevelly senna is much superior

in aspect to the ordinary India senna; having a fresher green colour, and being free from any admixture of the footstalks and other fragments of the plant.

A very good senna has, within a few years, been brought into the American market under the name of *Mecca senna*. The leaflets are in length and shape between those of the *C. acutifolia* and *C. elongata*, the latter of which, as found in the India senna, they resemble in their yellowish or tawny hue. It is probably derived from C. lanceolata of Forskhall.

Sensible and Chemical Properties. Senna has a pale-greenish or yellowish-green colour, a faint peculiar smell, and a sweetish, slightly bitter, somewhat nauseous taste. The powder is greenish. It yields its virtues readily to water and alcohol. The infusion, upon standing, deposits a precipitate, which is ascribed to the oxidation of its extractive matter, and has been supposed, though probably on insufficient grounds, to increase the griping property of the medicine. Infusion of galls, and solution of subacetate of lead precipitate the active matter of the leaves, and are, therefore, incompatible in prescription. It was at one time supposed that the active principle had been isolated, and the name of *cathartin* was, upon this supposition, conferred on the matter obtained; but further investigation appears to have determined, that the substance so named has little purgative power, and is, in fact, of complex composition.

Medical Effects and Uses. Senna was used by the older Arabian physicians; and notices of it are found in their writings as early as in the ninth century, though it was probably used long before. It is a prompt and very efficient cathartic, producing copious watery discharges, and often with considerable griping, but with little irritation of the mucous membrane. I have found it among the cathartics most readily retained by the stomach. The griping property is probably owing, not to that sort of irritation produced by the acrid cathartics, but to the direct and energetic influence of the medicine on the muscular coat of the bowels. It is the combination of this strong operation on the peristaltic movement with the property of increasing secretion into the bowels, that gives senna its peculiar character. It is purely cathartic, having no other special influence, to qualify its operation in this capacity.

Whether it operates by contact with the inner surface of the alimentary canal, or through the medium of absorption, has not been certainly determined; but it is not improbable that it conjoins both modes of action. That its cathartic principle is absorbed may be

inferred from the asserted fact, that the milk of nursing women, under the influence of the medicine, operates upon the bowels of the infant; and, if the experiment can be relied on, in which the infusion, injected into the veins of a man, produced vomiting and purging, we must admit that it may be capable of producing its special effect on the bowels through the circulation.

From its pure cathartic character, its promptness and efficiency, and its influence at once on the peristaltic motion and secretory function of the bowels, it may be used in all cases requiring active purgation, whether the indication be merely to evacuate the bowels, or to produce a depletory effect, or to obtain both effects at the same time.

It is an excellent cathartic for *acute inflammatory affections*, and generally for *fevers* when the circulation is vigorous, and the state of the system sthenic. In these cases, it is very usefully associated with the saline cathartics.

The combined power above mentioned peculiarly adapts it to cases of *obstinate constipation from fecal accumulation*, in which watery secretion is wanted in order to soften and break up the consolidated mass, and energetic contraction of the muscles to expel it.

It is also admirably adapted to cases of *bilious colic*, after the administration of calomel, and when other cathartics are rejected from the stomach. I have generally found small doses of a compound infusion of senna, such as will be recommended below, say one or two fluidounces, repeated every two hours, retained well by the stomach, and efficient as a cathartic.

Senna given in small doses, suitably combined, answers also excellently as a *laxative*, proving its want of any considerable irritant property.

It is much employed, in conjunction with spigelia, or other anthelmintic, for the *expulsion of worms*, to which the energy of the muscular contraction it produces well adapts it.

The *griping quality* may be in a considerable degree modified by administering senna in connexion with aromatics; and it is thought that the purgative salts, such as bitartrate of potassa, tartrate of potassa, and sulphate of magnesia, not only aid its operation, but, by a chemical influence upon the senna itself, or its active principle, alter it in such a manner as to diminish its disposition to gripe. Of the effect of this combination, in modifying the operation of senna, there is no doubt; but I am disposed to ascribe it to the physiological rather than the chemical influence of the salt used.

The same property of producing energetic peristaltic contraction, which renders it so efficient as a cathartic when taken by the stomach, adapts it also for use by *enema*, in cases of peculiar obstinacy.

Administration. Senna is not often given in powder, in consequence of its bulk. The dose of it, in this state, is from half a drachm to two drachms. Occasionally, I have known the powder to be taken as a laxative, mixed, in very small proportion, with stewed prunes, used as an article of diet. The taste is little perceived, especially if the fruit be prepared with molasses.

Confection of Senna (CONFECTIO SENNÆ, *U.S.*, *Lond.*, *Dub.*; ELECTUARIUM SENNÆ, *Ed.*), often called *lenitive electuary*, is another preparation in which senna is used in substance. In making it, a syrup, prepared from liquorice root and figs, is incorporated first with the pulps of prunes, tamarinds, and purging cassia, and then with a portion of finely powdered senna and coriander. This is an excellent compound laxative, with little or no unpleasant flavour, operating very kindly, and well adapted to the costiveness of pregnant women, that of convalescence, and that accompanying hemorrhoidal affections. It is not suited to dyspeptic cases. The dose is about two drachms, which may be most conveniently taken at bedtime.

Infusion is the most frequent form in which senna is exhibited. This may be prepared in the proportion of an ounce of senna, with one or two drachms of fennel-seed, cardamom, or coriander, to a pint of boiling water; though, in consequence of the tendency to precipitation on being kept, it is best to prepare only one-half the quantity at the same time. The dose is about four fluidounces. But it is almost always best to use one of the saline cathartics in connexion with the senna and the aromatic; and the addition of manna, while it adds to the cathartic property, answers a good purpose by correcting the taste. The following is an excellent formula.

A *compound infusion of senna* may be made by taking of senna half an ounce, of sulphate of magnesia and flake manna, each, an ounce, of fennel-seed a drachm, and of boiling water half a pint, and macerating in a covered vessel till the infusion becomes cool. One-third, or one-half of this quantity, may be given for full purgative effect, repeated, if necessary, in from four to six hours; or, in cases of somewhat irritable stomach, one or two fluidounces may be taken every hour or two till it operates.

There are two *tinctures of senna*, both of which are forms of the old *elixir salutis;* namely, the *Tincture of Senna and Jalap* (TINCTURA

SENNÆ ET JALAPÆ) of the U. S. Pharmacopœia, made of the two ingredients mentioned in the title, with the addition of cardamom; and the *Compound Tincture of Senna* (TINCTURA SENNÆ COMPOSITA) of the London and Dublin Colleges, containing various aromatics, with raisins, besides senna. In the dose of from two fluidrachms to a fluidounce, either of these tinctures may be used as an adjuvant to purgative infusions, to render them more stimulating in a debilitated state of the stomach, or as a cathartic, without addition, in persons habituated to the use of alcoholic drinks.

Syrup of Senna (SYRUPUS SENNÆ, *U. S.*) is made, according to the directions of our officinal code, by adding sugar to an infusion of senna and fennel-seed, and then evaporating; according to those of the London and Edinburgh Colleges, by first preparing a very strong infusion, and incorporating this with molasses, which has been previously boiled to evaporate the moisture, and is added to the infusion while still boiling hot. The latter syrup has the advantages, that its strength has not been impaired by the heat used in evaporation, and that the taste of the senna is concealed by that of the molasses. It is generally employed for children, in the dose of one or two fluidrachms.

Fluid Extract of Senna (EXTRACTUM SENNÆ FLUIDUM, *U.S.*) is peculiar to our Pharmacopœia. It is prepared by evaporating a tincture of senna sufficiently by means of the water-bath, and then adding sugar, and, after it has been dissolved, a little compound spirit of ether, or Hoffmann's anodyne, holding oil of fennel in solution. The ethereal addition is intended to aid in its preservation. It is an efficient preparation, if well made. The dose is half a fluidounce for an adult, and half a fluidrachm for a child a year or two old.

Subordinate to senna, as belonging to the same genus of plants, and having the same character, though somewhat weaker, the following cathartic may be suitably considered in this place.

AMERICAN SENNA.—CASSIA MARILANDICA. *U.S.*—*Wild Senna.* This consists of the leaflets of *Cassia Marilandica*, an indigenous herbaceous perennial plant, sending up annually several erect simple stems, which rise usually three or four feet, and are furnished with pinnate leaves, and, in July and August, with handsome yellow flowers. The leaflets, which should be gathered towards the close of summer or beginning of autumn, are usually somewhat less than two inches long, from three to six lines broad, oblong-lanceolate

and mucronate or pointed, thin and pliable, and of a pale-green colour. They are usually kept in the shops in the form of oblong cakes, prepared by the Shakers, in which leaves, footstalks, and flowers are usually compressed together. Their odour is faint, their taste somewhat like that of senna. They yield their virtues to water and alcohol.

American senna is an efficient cathartic, having the peculiar characters of the imported senna, and, like that, much disposed to produce griping pain. It may be employed for the same purposes, but must be given in a dose one-third or one-half larger. The usual form of administration is that of infusion, which should be made in the proportion of six drachms to half a pint, of which one-half may be given for a dose. Like senna, it should be corrected by the addition of an aromatic, and saline cathartic.

Experiments made by Mr. E. L. Perot, with a fluid extract carefully prepared from parcels of the leaves collected both in spring and autumn, would seem to prove that, in this form of preparation at least, the American senna is nearly or quite inert as a cathartic. (*Am. Journ. of Pharm.*, xxvii. 301.) In order to test the virtues of the leaves in infusion, I had half a pint carefully prepared by Mr. Procter, with six drachms of the leaves and half a drachm of fennel-seed. This I found to operate moderately as a laxative in the dose of two fluidounces, and pretty actively as a purgative in that of four fluidounces, with the griping effects of senna.

VI. JALAP.

JALAPA. *U. S., Lond., Ed., Dub.*

Origin. Jalap is the root or tuber of *Ipomæa Jalapa* (*Ipomæa Purga*, Hayne; *Exogonium Purga*, Balfour), a climbing plant, with long, slender, twisting stems, cordate-hastate leaves, and beautiful blue-coloured or purplish funnel-shaped flowers. This plant is a native of Mexico, growing at an elevation of a mile or more above the sea, in the neighbourhood of the town of Xalapa or Jalapa, from which the medicine derived its name. The root or tuber, after being dug up, is dried whole, or sliced, or deeply incised to aid in the drying, and is then sent in bags to Vera Cruz, whence it is exported.

Properties. The drug as brought to us consists of the dried tubers, either whole, or in longitudinal or transverse slices, and

often incised in different directions. They vary, in magnitude, from that of a large chestnut to nearly the size of the fist. They are irregularly pear-shaped, roundish, ovate, or somewhat spindle-shaped, much wrinkled, heavy, compact, hard, and brittle, with a fracture, which, in the perfectly sound root, is somewhat shining and resinous in appearance. The colour of the outer surface is dark-brown or gray, that of the fractured surface diversified with alternating veins of a dark and shining, and of a yellowish-gray and amylaceous aspect; the former being denser and harder than the latter. The more there is of the darker-coloured portion, the stronger may the root be deemed in purgative power. The powder is yellowish-gray. Jalap has a heavy and sweetish odour; and the powder, when inhaled into the nostrils and throat, is highly irritant, and provokes sneezing and coughing. The taste is sweetish, disagreeable, and decidedly acrid. It yields its purgative properties entirely to alcohol. Water extracts these very imperfectly, if at all, but dissolves certain mucilaginous or extractive matters, which appear to have a qualifying influence over the cathartic action of the jalap, and have been said to be somewhat diuretic. Diluted alcohol is the best solvent.

Chief Constituents. The prominent ingredients of jalap, besides ligneous fibre, are on the one hand resinous matter soluble only in alcohol, and on the other starch, gummy, extractive, and saccharine matters which are dissolved by water. The purgative property resides in the former. As the *resin* is an officinal preparation, the mode of preparing it, and its peculiar properties will be detailed when the different forms in which jalap is administered are considered.

Jalap in tubers is sometimes attacked by worms, which, however, confine themselves to the amylaceous portion, leaving the dark resinous part unconsumed; so that, instead of being weakened, the purgative power of the root is relatively increased. Light, whitish, amylaceous, or woody pieces are inferior, and should be rejected in pulverization. The drug is often adulterated; and, in employing the powder, as obtained indiscriminately in the drug market, I have often found it to fail of producing any decided effect, in the ordinary medicinal doses.

Medical Effects and Uses. Jalap was known in Europe near the beginning of the seventeenth century. It is locally irritant; and, when confined in the alimentary canal in dogs, as by tying the œsophagus, two drachms of it are said to have proved fatal,

probably by provoking gastric inflammation. In the human subject, in full doses, it operates briskly as a cathartic, producing copious watery discharges, and sometimes causing nausea and griping, by its irritant influence on the mucous membrane. It takes rank, therefore, with the hydragogues; but, though somewhat acrid, it is scarcely sufficiently irritant to merit a place among the drastic purges. In excessive doses it may produce hypercatharsis, and thus possibly endanger life in feeble persons; but I have met with no instance of death from it on record. In the ordinary medicinal doses, it is perfectly safe, and may be given even to children without hesitation when indicated. It has no heating effect on the system, and no direct tendency to excite the circulation. It probably operates mainly by a direct influence on the alimentary canal; but is said to purge when applied to a wound, and would seem, therefore, to be capable of acting through the circulation.

Jalap may be administered in any case, where a cathartic of brisk and rather quick action is required; and may, therefore, be given in febrile and inflammatory diseases, with a sthenic state of system; and its hydragogue property particularly adapts it to dropsical affections, in which the purgative treatment may be preferred. It is, however, seldom administered alone; being generally employed to give increased energy to other cathartics, given with some special view.

It is very often combined with *calomel*, in the treatment of cases requiring the stimulant influence of the latter remedy upon the liver; as in the commencement of bilious and yellow fevers, hepatic inflammation, and the congestion of the portal circulation, so apt to occur in hot seasons and tropical latitudes. The powerful revulsive influence of this combination upon the abdominal viscera renders it also peculiarly useful in strong vascular determination to the brain, as in existing or threatened apoplexy, meningitis, and acute mania.

Another frequent combination of jalap is with *cream of tartar*, the refrigerant influence of which unites with the powerful hydragogue action of the former, to render the mixture efficacious in dropsies, particularly those of a febrile or inflammatory character. The same combination is very useful in rheumatic and scrofulous inflammation of the larger joints, attended with some fever. The late Dr. Physick used to employ it with great effect, in connexion with rest, and a restricted diet of mush and milk, in the treatment of inflammation of the hip and knee-joints in children. He gave a full dose, two or three times a week, and noticed that, instead of becoming

emaciated, children not unfrequently grew fat under the treatment, as the local disease diminished.

Administration. The *dose* of jalap is from fifteen to thirty grains. Twenty grains is a full medium dose, if the medicine is of good quality. To a child three or four years old from four to eight grains may be given. For children younger than this the medicine is rarely required.

A favourite combination of Dr. Rush was ten grains of calomel and ten of jalap. Five grains of the former and fifteen of the latter may also be given advantageously.

When combined with cream of tartar, from ten to twenty grains may be given with one or two drachms of the salt. In the officinal *Compound Powder of Jalap* (PULVIS JALAPÆ COMPOSITUS, *U.S.*, *Lond.*, *Ed.*, *Dub.*) one part of jalap is mixed with two of cream of tartar, and the mixture is given in the dose of from thirty grains to a drachm; but the proportion of bitartrate of potassa is too small to have any very perceptible effect.

The powder may be given, mixed with syrup or molasses. Its large bulk renders it desirable to obtain the virtues of the medicine in a concentrated state. Hence different extracts have been prepared, and are much used. According to the late Dr. Duncan, the aqueous extract of jalap purges moderately with little griping, and increases the flow of urine. That obtained from the root previously exhausted by alcohol, does not purge, but acts as a diuretic. The alcoholic extract purges actively, and often gripes severely. The inference is that, to obtain the virtues of jalap in an extract, the best measure is to employ both menstrua. This plan has been adopted in the U. S. Pharmacopœia.

Extract of Jalap (EXTRACTUM JALAPÆ, *U.S.*, *Lond.*) is prepared by first exhausting jalap with alcohol, and subsequently with cold water, evaporating the tincture and infusion separately to the consistence of honey, then mixing them, and evaporating to dryness. A reddish-brown extract is thus procured, having all the medical properties of jalap, and producing the same effects in a dose somewhat more than half that of the powder, say about twelve or fifteen grains. It is, however, much more used in combination than separately, and is one of the ingredients in the *compound cathartic pills.*

Alcoholic Extract of Jalap (EXTRACTUM *sive* RESINA JALAPÆ, *Ed.*) is prepared by simply treating jalap with alcohol, and evaporating the tincture. The resin is thus obtained dark-coloured and

impure. If it be desired to procure it pure, jalap, mixed with animal charcoal, may be percolated with alcohol, and the tincture thus obtained precipitated with water. The resulting product is perfectly white, and operates actively in the dose of from three to five grains. But the resin of jalap is apt to act harshly, and to produce griping pains; and it is considered best to modify it by admixture with some demulcent substance, as sugar or almond emulsion. It is probable that the mucilaginous and extractive matters in jalap serve a useful purpose, by qualifying the harshness of the resinous ingredient, through their intimate admixture. The U. S. and London extract is, I think, on this account preferable; and, if it be the fact, as has been supposed, that the matter soluble only in water acts as a diuretic, this is another ground for the preference of it, especially in dropsical diseases. The medium dose of the impure alcoholic extract is seven or eight grains.

Tincture of Jalap (TINCTURA JALAPÆ) is officinal with all the authorities, both British and American. The dose is one or two fluidrachms, which may be added to cathartic infusions or mixtures, to give them increased activity, or render them somewhat more stimulant to the stomach.

VII. MAY-APPLE.

PODOPHYLLUM. *U. S.*

Origin. Podophyllum is the officinal name adopted for the root of *Podophyllum peltatum*, commonly called *may-apple*, or *mandrake*, an indigenous perennial herbaceous plant, growing in woods, newly cleared grounds, and low meadowy places, in most parts of the United States. The root or rhizome runs horizontally a little below the surface, and at intervals sends up single stems, which soon divide into two leafstalks, each bearing a broad shield-like, deeply lobed leaf, into the back of which it is inserted. From the fork of the stem springs a short peduncle, bearing a handsome white flower, appearing in spring, and followed by the fruit, which, when ripe early in the autumn, is about the size and shape of a lime. The root is collected after the fall of the leaf in autumn.

Properties. As kept in the shops, the root is in pieces of variable length, about two lines thick, swelling into knots at short intervals, wrinkled longitudinally, of a dark reddish-brown colour externally

and whitish within. Lighter-coloured, yellowish radicals usually accompany it, either separate, or connected at the joints. The colour of the powder is yellowish-gray. The smell of the root in powder is sweetish and not disagreeable; its taste, bitterish, subacrid, and nauseous. It imparts its bitterness to water, and all its virtues to alcohol, which is, therefore, the better menstruum.

Chief Constituents. A *bitter principle* was extracted from the root by Mr. Wm. Hodgson, Jun., which, however, does not seem to possess its purgative properties. These appear to depend on resinous matter, which, according to Mr. John R. Lewis, consists of two distinct resins, one soluble in ether and alcohol, the other only in alcohol, and both possessed of cathartic properties. According to Dr. Manlius Smith, the resin may be obtained pure and white by precipitating the tincture with water, as in the mode for preparing the pure resin of jalap. In this state, it produces purgative effects in the dose of two or three grains, and appears to merit the name of *podophyllin* proposed for it. (*U. S. Dispensatory.*)

Medical Properties and Uses. Podophyllum is an energetic cathartic, producing, in a full dose, several copious watery stools, without much uneasiness to the patient, though, like most other active cathartics, it occasionally causes nausea and griping. It has been thought to resemble jalap closely in its purgative properties; and this opinion, which was the result of observation, has been confirmed by the discovery of a similar analogy in the nature of its cathartic principle. It may be substituted for jalap in all cases in which that medicine is applicable, though believed to be somewhat slower in its operation. A respectable medical practitioner in the country informed me that, in small doses, insufficient to purge, he uses this medicine habitually in phthisis and other pulmonary affections, having found it to allay cough and diminish the frequency of the pulse. It is said also to be alterative in its action on the liver. The medium *dose* for full purgative effect is twenty grains.

Extract of May-apple (EXTRACTUM PODOPHYLLI, *U. S.*) is directed by our Pharmacopœia to be prepared from the root, in the same manner as the extract of jalap. It has all the virtues of the root, and may be given in the dose of from five to fifteen grains. The pure resin, as stated above, is much more powerful; operating in the dose of two or three grains; but it is also more apt to irritate. When employed, it should be conjoined with some demulcent substance to cover its acrimony.

b. *Saline Purgatives.*

Most of the salts of the alkalies, and the soluble salts of the alkaline earths act as cathartics, when given in quantities sufficiently large. Some of them, however, have other properties which forbid their use in large doses; others are not sufficiently certain and regular in their operation for practical purposes; and comparatively few are actually employed as cathartics. I shall treat only of the sulphates of magnesia, soda, and potassa, the phosphate of soda, the bitartrate and tartrate of potassa, the tartrate of potassa and soda, and the citrate of magnesia.

Effects on the System. When one of the salts is administered in small doses, insufficient to act as a cathartic, and frequently repeated, it often appears to operate as an arterial sedative or refrigerant on the system at large, somewhat reducing the circulation and general temperature, and very generally increasing one or more of the secretions, especially the urine or perspiration. Under these circumstances, the salt is absorbed, acts through the blood directly upon the circulatory organs, and, being thrown off by the kidneys or skin, stimulates their excretory function.

In relation to the salts of the vegetable acids which pursue this course, it is believed that, in the process of absorption, or anterior to it, their acid is separated and undergoes digestion, and the base enters the circulation, and escapes by the emunctories, either in the form of a carbonate or a chloride, or in some other state of saline combination. The salts with mineral acids are absorbed unaltered, or undergo change through reaction with other salts or acids they may happen to meet with, according to the predominance of affinities.

More largely given, the salts act in general very promptly as cathartics, producing liquid evacuations even in small doses, and, in the full dose, operating usually more than once, with copious watery discharges, and little pain or discomfort to the patient. They produce the cathartic effect by increasing the serous exhalation from the mucous membrane; and, being mainly carried off with the contents of the bowels, are less liable to absorption, and consequently less disposed to produce a direct refrigerant effect, or to act upon other emunctories. Their chief influence, therefore, is depletory; but it can scarcely be doubted that they are partially absorbed, and in some degree operate as direct arterial sedatives, and secretory excitants. It is not merely water that they separate from

the blood, but soluble animalized matters also, on which the circulating fluid depends in part for its nutritive properties. Through this combined influence, they have a powerful effect in reducing the quantity and character of the blood, and thus diminishing the force of the circulation, the heat of the body, and the general strength. Though thus energetic in modifying the condition of the system, they are usually mild in their manner of operating, and, if properly administered, are little apt to produce injurious irritation of the mucous membrane.

A result I have often noticed, after the free operation of one of the saline cathartics, is a diminution of the secretion of bile, as indicated by a deficiency or want of its colouring matter in the passages. This is obviously owing to the depletion from the portal system through its radicals; so that the blood goes to the liver diminished in quantity and lowered in quality, and for a time inadequate to the due stimulation of that organ.

The saline cathartics lose their power, upon repetition, less than any other medicines of this class. I have known small doses of sulphate of magnesia to be taken every few days for months, and somewhat irregularly even for many years, and yet to operate as readily in the end as at the beginning.

Mode of Operating. The most reasonable explanation of the purgative operation of saline substances appears to be, that, by a direct stimulant influence on the capillaries of the gastro-intestinal mucous membrane, they invite into them an additional quantity of blood, which excites them to increased exhalation. Some are disposed to explain the phenomena on pure physical principles. A strong saline solution outside of the blood-vessels causes, they say, an endosmotic current from the thinner serum of the blood, into the more concentrated liquid of the bowels. On the contrary, a very weak solution, being less dense than the serum, enters the blood through the same law. Hence a large dose of one of the salts purges, while a small one is absorbed, and acts on the system and the emunctories. But, unfortunately, the theory does not conform altogether with well-known facts. A saline solution is not most apt to purge when most concentrated; and very weak solutions, taken with a large quantity of liquid, do often purge with considerable activity; as, for example, many of the cathartic mineral waters, which contain a relatively small proportion of saline matter.

The fact seems simply to be, that a very strong solution irritates so highly, as, upon principles already sufficiently explained, to im-

pair the functions of the membrane, and, among others, that of secretion, and may even induce serious inflammation; a less concentrated solution, though still rather strong, simply irritates to the point of increasing secretion, and consequently purges; while a very weak one, if in moderate quantity, scarcely irritates at all, and is consequently absorbed. If the weak solution be taken in very large amount, as when glass after glass of a natural mineral water is drank, the distention by quantity, added to the slight irritant influence of the salt, is sufficient to stimulate the peristaltic movement. Some interesting experiments upon this point have been made by Dr. Joseph Jones, which tend, on the whole, to confirm the views here taken. (See *Am. Journ. of Med. Sci.*, N. S. xxxi. 61.)

Therapeutic Application. The saline cathartics are especially adapted, by their peculiar properties, to cases of disease, in which, in connexion with a purgative action on the bowels, there are indications for depletion from the blood-vessels, and a refrigerant effect on the system.

1. Hence, they are well adapted to *acute inflammation*, with or without fever; and, to a certain extent, are, upon the same principles, applicable to the *chronic forms*. They are, indeed, almost universally used in this class of affections, when a purgative is wanted. Very often, especially in the milder cases, they are alone sufficient for the treatment. I have often known a commencing inflammation, as of the fauces, for example, to be entirely set aside by a full dose of Epsom salt, with a low diet. But, in severer cases, it is customary to commence the treatment with some other more energetic cathartic, capable of a more powerful revulsive influence, as calomel and jalap, calomel and rhubarb, compound cathartic pills, &c.; and afterwards to trust the case to the saline remedies of the class, sometimes, when a more than usually effective impression may be required, combined with senna and manna, as in the *black draught*.

2. *Fevers of a sthenic character* are also very advantageously treated with saline cathartics, often, indeed, to the exclusion of all other medicines belonging to the class; though peculiar circumstances sometimes call for special cathartics, as when calomel is wanted to correct hepatic torpor and portal congestion; castor oil, in cases attended with irritation or inflammation of the intestinal mucous membrane; magnesia, to correct acid in the stomach or

bowels; and one or more of the drastics, to create a powerful revulsion from the head towards the alimentary canal.

3. In cases of large *feculent accumulation*, producing *obstruction of the bowels*, the more energetic saline cathartics often operate happily, through the abundance of the watery secretion they occasion, which tends to soften and break down the consolidated mass, by insinuating itself between the mass and the sides of the bowel, or even into its very substance.

4. When a *prompt and thorough evacuation of the bowels* may be required, and castor oil may be rejected, or not sufficiently active, the saline cathartics are often resorted to with advantage; being usually combined with magnesia or its carbonate, when excess of acid is at the same time present.

5. In the treatment of *dropsy*, whenever cathartics are indicated, the saline are among the most efficient, through their hydragogue operation, and the consequent promotion of absorption. It is to the febrile form of dropsy that they are peculiarly adapted.

6. They may be used generally when it is desired to evacuate the bowels, without reference to special indications; care, however, being taken that no existing contraindication be neglected.

7. Finally, they are often called for, to hasten the operation of other and slower cathartics, given with some special view.

The chief *contraindication* is a state of debility, in which no blood can be spared, and evacuation of the bowels, should it be necessary or desirable, must be effected by cathartics operating exclusively on the motor function. The salts are also contraindicated in local *debility of the stomach and bowels*, which they tend to aggravate, and in *torpor of the liver*, unless they are given in connexion with a mercurial alterative.

I. SULPHATE OF MAGNESIA.

MAGNESIÆ SULPHAS. *U.S., Lond., Ed., Dub.*

Syn. Epsom Salt.

Preparation. Sulphate of magnesia exists in nature as an ingredient of sea water, and the water of certain springs, and is occasionally found in caves, and efflorescing on the surface of soils, which either contain it, or the materials out of which it is formed by chemical reaction. For use it has been procured from various sources. Formerly most of the salt used was obtained by evapo-

ration and crystallization, from bittern, which is the mother-water left after the crystallization of common salt from concentrated sea-water. Thus procured, however, the salt contained a little chloride of magnesium, which, from its deliquescent property, disposed it to be always moist. In Great Britain, most of it is now prepared from magnesian limestone, consisting of the carbonates of magnesia and lime, which, being treated with dilute sulphuric acid, yields the sulphates of magnesia and of lime, which are separable by their very different solubilities. Our own markets are chiefly supplied with a beautiful form of the salt, largely manufactured, in Philadelphia and Baltimore, from magnesite or silicated hydrate of magnesia, by saturating the powdered mineral with sulphuric acid, calcining the resulting compound in order to separate iron, and then purifying the sulphate of magnesia by repeated solution and crystallization.

Properties. As usually kept in the shops, sulphate of magnesia is in fine transparent acicular crystals, produced by agitating the solution at the moment of crystallization. When carefully crystallized, it forms larger four-sided prisms, terminated by two or four-sided summits. It is slightly efflorescent, inodorous, of a saline, bitter, nauseous taste, soluble in its own weight of water at 60° Fahr., and in three-quarters of its weight of boiling water, and insoluble in alcohol. When heated, it melts in its water of crystallization, which is driven off by a continuance of the heat. The crystals contain about 51 per cent. of water of crystallization; and the salt is consequently twice as strong in the anhydrous form as in the crystallized. In the latter state, it consists of one equivalent of acid, one of base, and seven of water.

Incompatibles. This salt is decomposed by the alkalies and their carbonates; by lime, baryta, and their soluble salts; by the soluble salts of lead, with which it forms insoluble sulphate of lead; by a solution of nitrate of silver containing fifteen grains to the fluid-ounce; and by solutions of the protosalts of mercury, but not the persalts or corrosive sublimate.

Medical Uses. Sulphate of magnesia was known as a purgative so long since as near the close of the seventeenth century, when it was procured from the waters of Epsom springs, in England, by Dr. Grew; but it was relatively little employed until after the beginning of the present century. It is now the saline cathartic most used, having for more than thirty years superseded sulphate of soda, and completely usurped the common name of *salts*, form-

erly attached to that cathartic. It is an excellent saline purgative, possessing all the properties of this subdivision of cathartics in a high degree, and preferable to sulphate of soda, which alone equals it in efficiency, on account of its less disagreeable taste, and greater acceptability to the stomach. It may, therefore, be used for all the purposes to which the saline cathartics are applicable. In colica pictonum, it has the additional advantage of forming an insoluble sulphate of lead with any salt of that metal which may happen to be in the primæ viæ, and thus acting, in some measure, as an antidote.

The full medium dose of the salt is an ounce; but it will generally operate in half the quantity; and even a drachm or two, taken before breakfast or at bedtime, will often open the bowels once at least. The dose may be given dissolved in from two to four ounces of water. When the stomach is irritable, the best mode of exhibition is in solution in carbonic acid water, flavoured with lemon syrup. The unpleasant effect of its taste may be entirely counteracted by the following method of exhibition. The requisite dose being dissolved in the least quantity of water, let the patient draw a full breath, then swallow the solution quickly, and immediately afterwards a little lemonade, or some other agreeably sapid liquid, before allowing the breath to escape. Persons who usually shudder at the thought of the medicine, can take it in this way without the least inconvenience.

This salt is often given with the infusion of senna, the griping effect of which it is thought to counteract; and frequently also with magnesia, when there is excess of acid in the primæ viæ. In gouty and rheumatic diseases it is often associated with magnesia and wine of colchicum root, as recommended by Scudamore. The formula which I generally employ is half an ounce of the sulphate, half a drachm of the magnesia, and twenty drops of the wine.

II. SULPHATE OF SODA.

SODÆ SULPHAS. *U.S., Lond., Ed., Dub.*

Syn. **Glauber's Salt.**

Preparation. Though sulphate of soda exists in nature, in certain springs and ponds, it is always obtained for use artificially, being usually the residue, or an incidental product of chemical processes, intended for the preparation of some other substance.

Thus, it is left when common salt is decomposed by sulphuric acid in the process for procuring muriatic acid, and is obtained, through the reaction of the same materials, as one of the steps in the manufacture of carbonate of soda on the large scale.

Properties. Sulphate of soda is in large, six-sided, beautifully transparent, striated crystals, which effloresce rapidly on exposure, and are almost always partially effloresced as found in the shops. In time, it is thus completely deprived of its water of crystallization, and falls into an opaque, white powder. It is inodorous, of a cooling, bitterish, saline, and very disagreeable taste. It varies extremely in solubility with the temperature, requiring near the freezing point about 20 parts of water, and at about 91° Fahr., when its solubility is greatest, only about one-third of its weight; while at 60° it requires three times its weight, and at 212° its own weight. Alcohol does not dissolve it. At a moderate heat it liquefies in its water of crystallization, upon the continuance of the heat dries, and at a red heat melts, and loses all its water, amounting to somewhat more than 55 per cent. It consists of 1 equivalent of acid, 1 of base, and 10 of water. Of course, it has in its effloresced state about twice the strength of the crystals.

Incompatibles. It is decomposed by carbonate of potassa, and the soluble salts of lime or calcium, baryta or barium, lead, and protoxide of mercury, and also by solutions of nitrate of silver containing fifteen grains or more to the fluidounce.

Medical Uses. This salt was discovered about the middle of the seventeenth century by Glauber, after whom it was named. It has the characteristic effects of the saline cathartics, and may be used for all the purposes which they are given to fulfil. It was formerly in common use, but has been almost entirely superseded by the sulphate of magnesia. Some, however, by a singular idiosyncrasy, prefer its taste to that of the latter salt; and these should always be gratified in their choice. The medium full dose of the crystals is an ounce. When taken, it should be dissolved in water a little heated, by which its solution is much more speedily effected than by cold water.

III. SULPHATE OF POTASSA.

POTASSÆ SULPHAS. *U.S., Lond., Ed., Dub.*

Syn. **Vitriolated Tartar.**

Preparation. This is usually a secondary product of chemical processes, intended for the preparation of other substances. One of these is the process for procuring nitric acid from nitrate of potassa by the addition of sulphuric acid, which, in order to insure the complete decomposition of the salt, is used in such proportion as to form a bisulphate with the potassa left behind, when the nitric acid passes over. The bisulphate is converted into the sulphate, either by the addition of carbonate of potassa, or by abstracting the excess of sulphuric acid by means of lime or its carbonate, or by igniting the salt so as to decompose and drive off the excess of acid.

Properties. Sulphate of potassa crystallizes in the form of short six-sided prisms, ending in six-sided pyramids; or the two pyramids are united at their base, without the intervening prism. They are white, very hard, without smell, of a bitterish, saline, unpleasant taste, unchangeable in the air, soluble at ordinary temperatures in a proportion of water varying, according to different authorities, from 9.5 to 16 parts, considerably more soluble in boiling water, and insoluble in alcohol. They decrepitate when thrown into the fire, but contain no water of crystallization. The salt consists of 1 eq. of sulphuric acid and 1 of potassa.

Incompatibles. Sulphate of potassa is decomposed by the soluble salts of lime, baryta, silver, and lead. Tartaric acid added to its solution throws down the bitartrate of potassa.

Medical Properties. Until recently, sulphate of potassa was considered as a mild and quite safe cathartic, having the general properties of the saline substances belonging to the class, with the addition of deobstruent properties in small doses, which were supposed to render it valuable in certain cases of disease. But, in the year 1843, attention was called, in the *Pharmaceutical Journal and Transactions* (iii. 256), to its supposed possession of poisonous properties, in consequence of death having occurred, in several instances, to patients under its use. In one case, which occurred in England, two ounces were given at once, on two successive occasions, to a pregnant woman, who was seized with violent vomiting, followed by great exhaustion and death. On examination of the

body, congestion of the brain was found, with hemorrhage to the amount of two ounces. It is very obvious that the salt was not, in this case, the immediate cause of death, though it may have induced the violent vomiting, and this may have led to an apoplectic seizure, by the rupture of a blood-vessel in the brain. In the same paper, other cases are referred to which had happened in France not long previously. A puerperal woman, a week after confinement, upon taking somewhat less than two drachms of the salt, was seized with vomiting and violent pains in the stomach and limbs, which recurred with increased violence at each of five succeeding doses that were taken; and death happened soon afterwards. But it is extremely doubtful how far the fatal result, in this case, was ascribable to the salt, considering the state of the woman, and the fact that she was not under medical attendance. In a third case, which appears to be well authenticated, a female who was but just over her confinement, but was in good health, wishing to repress a too abundant secretion of milk, took six hundred grains in three doses. The first dose was rejected, the second induced vomiting, purging, and cramps, and after the third she died with symptoms of cholera. After death, a portion of the salt was found undissolved in the stomach, which exhibited signs of inflammation. From the above facts, and from others which have been published, it may be concluded that, in over-doses, sulphate of potassa is capable, in certain cases, of producing irritation and possibly inflammation of the stomach, which, through the excessive vomiting and purging produced, may give rise to fatal prostration. In opposition to the immense mass of testimony in favour of the general innocence and mildness of the medicine, the facts mentioned afford no ground for ascribing poisonous properties to the salt; for even the most innocent substance, given in great excess, or under certain unfavourable circumstances, may produce the same effect.

Sulphate of potassa has been much used, in small doses, from a drachm down to fifteen grains, as a mild aperient in dyspepsia, chronic hepatic affections, hemorrhoids, &c., and has been supposed by some to possess resolvent or deobstruent properties in enlarged liver, and swollen abdominal glands in children. It has been usually given for this purpose in connexion with rhubarb; from five to ten grains of the root being mixed with from fifteen to sixty grains of the salt. It has been supposed also to possess the property of restraining the secretion of milk; and an idea that it promotes abortion must have got abroad among the vulgar, for, in one of the

fatal cases above referred to, it was given with a view to that effect. Nevertheless, I very much doubt whether it has any other powers than those which belong to the neutral alkaline salts in general.

As a mild purgative, it may be given in a dose of from three to six drachms; but care should be taken that it is dissolved. Its difficult solubility is a great disadvantage; and it is highly probable that, when it has produced inflammation, the result has been owing to its exhibition in the state of powder, the hardness of the spiculæ of which may have proved the source of the injury.

IV. BITARTRATE OF POTASSA.

POTASSÆ BITARTRAS. *U.S., Lond., Ed., Dub.*

Syn. Cream of Tartar.—Crystals of Tartar.—Supertartrate of Potassa.

Preparation. The juice of the grape contains a considerable proportion of bitartrate of potassa. When undergoing the vinous fermentation, it gradually deposits this salt, because the alcohol produced renders the water of the juice less capable of holding it in solution. A crust is thus formed upon the inner surface of the cask, which, on being removed, constitutes crude tartar, or argol. This is sometimes white, and sometimes reddish, according to the character of the wine. The bitartrate of potassa, which is the chief ingredient, though mixed with numerous impurities, is obtained from it by repeated solution in water and crystallization. The crystals deposited are called the *crystals of tartar.* In the process of evaporation, when the solution has become saturated, and is allowed to cool, a layer of very minute crystals forms on the surface of the water, which, when separated, are designated as the *cream of tartar.* But the latter name has been extended so as to apply to the salt in a state of powder, however prepared, and, indeed, to the medicine in all conditions, without reference to its state of aggregation. The crystals are imported from France, and powdered after reaching this country. In the retail shops, the salt is always kept in the form of powder.

Properties. As imported, bitartrate of potassa is in the state of small irregular lumps or masses, consisting of small crystals aggregated together, which are whitish, translucent, permanent in the air, hard, and, when chewed, gritty under the teeth. The powder is beautifully white, soft, inodorous, of a sour, not disagreeable

taste, of difficult solubility in water, requiring 180 parts of cold and 18 of boiling water for solution, and insoluble in alcohol. The addition of borax or boracic acid renders it much more soluble in water. The watery solution undergoes spontaneous decomposition on exposure. At a red heat, the salt is decomposed, being converted into vapours, which escape, and a mixture of charcoal with carbonate of potassa, which remains.

Composition and Chemical Reactions. Bitartrate of potassa contains two equivalents of tartaric acid, one of potassa, and one of water; and the water cannot be separated without destroying the salt. By means of other alkaline bases, or their carbonates, the excess of tartaric acid is saturated and double salts formed. Potassa or its carbonate converts it into the neutral tartrate. The bitartrate effervesces with alkaline carbonates, and, in solution, affords precipitates with lime-water and the soluble salts of lime or calcium, baryta or barium, and lead.

Medical Properties and Uses. Cream of tartar has the properties of the saline cathartics generally. While less energetic as a purgative than sulphate of magnesia, it is probably even more hydragogue, certainly more refrigerant, and more apt to be absorbed and act upon the kidneys. It is somewhat disposed to produce flatulence and griping, probably in consequence of the decomposition of a portion of the tartaric acid. When long continued, it is thought to weaken digestion, give rise to various dyspeptic symptoms, and produce emaciation. But these effects have, I think, been exaggerated, for I have often given it for weeks and months together; and though, like all other cathartics, it will sometimes occasion uneasiness and other unpleasant symptoms, yet I know none which can be borne better upon the whole, unless it may be rhubarb and the mildest laxatives. In great excess, it may possibly, as has been stated, inflame the bowels. The case of a drunkard is on record, who, to obviate the effects of drinking, took four or five tablespoonfuls of the powder, and was soon afterwards attacked with vomiting, purging, and other symptoms of gastro-intestinal inflammation, of which he died. (Tyson, *Lond. Med. Gaz.*, xxi. 177.) But I have, in many dropsical cases, administered two ounces daily of cream of tartar, for weeks, in divided doses, and never yet saw any effects which were at all dangerous in their character; and cannot help suspecting, that the previous debauch of this patient had more to do with the result than the cream of tartar.

This cathartic is admirably adapted to the treatment of dropsy;

but, as it is more efficient in that complaint when used to increase the urine, than with a view to its purgative effects, it will be most appropriately considered with the diuretics, in reference to this application.

When used as a cathartic in dropsy, cream of tartar is most frequently combined with jalap. (See *Jalapa*, pages 512, 513.)

Associated with sulphur, it is much used in painful and inflamed *hemorrhoids*. Equal parts of the two may be mixed, and two drachms of the mixture given for a dose.

Added to senna tea, in the proportion of one or two drachms to the pint, it is thought to lessen the tendency of that cathartic to gripe.

It is not unfrequently employed in solution, as a laxative and refrigerant drink, in febrile complaints. For this purpose, from a drachm to a drachm and a half may be dissolved in a pint of boiling water, and flavoured with sugar and lemon-peel, or oil of lemons. This drink, which is called *imperial*, is not very different in taste from lemonade, and may be taken at pleasure.

The dose of bitartrate of potassa is one or two drachms as a laxative, and from half an ounce to an ounce as a cathartic. In small quantities, it may be taken in the form of an electuary with molasses or syrup; but, on the whole, the best method of administration is to suspend it by agitation with water, or some mild aromatic infusion, to prevent griping, as fennel-seed tea.

V. TARTRATE OF POTASSA AND SODA.

SODÆ ET POTASSÆ TARTRAS. *U.S.*, *Dub.*—SODÆ POTASSIO-TARTRAS. *Lond.*—POTASSÆ ET SODÆ TARTRAS. *Ed.*

Syn. Rochelle Salt.—Salt of Seignette.—Tartarized Soda.

Preparation and Composition. The salt is prepared by saturating the excess of tartaric acid of the bitartrate of potassa by means of carbonate of soda; the former salt being gradually added, in powder, to a boiling hot solution of the latter, until carbonic acid ceases to escape, and saturation takes place. The solution is then concentrated and crystallized. A salt is thus obtained, consisting of one equivalent of tartrate of potassa and one of tartrate of soda, with eight or ten equivalents of water; the proportion of the water being differently stated by different authorities.

Properties. Rochelle salt is in fine, large, colourless, prismatic crystals, which, when perfect, have eight or ten unequal sides, but

often appear as if split longitudinally into two portions. These crystals are inodorous, of a saline slightly bitterish taste, less disagreeable than that of most other purgative salts, soluble in four parts of cold and much less of boiling water, and insoluble in alcohol. They are slightly efflorescent, and, when heated, first melt, and then give out their water of crystallization. At a high temperature they are decomposed, and, if the ignition has been conducted in close vessels, a mixture of charcoal and the carbonates of potassa and soda is left behind.

Incompatibles. Tartrate of potassa and soda is decomposed by most acids and acidulous salts, which abstract the soda, and reconvert the salt into bitartrate of potassa. It is also incompatible with the soluble salts of lime or calcium, and lead, with the basis of which its tartaric acid forms insoluble tartrates.

Medical Properties and Uses. This salt has been in use since the year 1672, when it was first prepared by Seignette, an apothecary of Rochelle, in France, whence it derived two of the names by which it is commonly known. It has all the properties of the saline cathartics generally, but is milder than the sulphates of magnesia and soda, and of a less disagreeable taste, and probably sits somewhat better on the stomach.

In small doses, of about a drachm every two or three hours, it seldom purges much; but is absorbed, and, its acid being decomposed, renders the urine alkaline.

It is much employed as an aperient in delicate persons, when a gentle refrigerant effect is indicated, together with evacuation of the bowels. Within a short period, it has been considerably employed in the treatment of inflammatory rheumatism, with the view of rendering the blood more alkaline. I have imitated the practice in several cases. The salt is given in the dose of a drachm every two or three hours. In the course of three or four days, the urine, if at first acid, generally begins to undergo change, gradually passing to an alkaline condition; and not unfrequently an amelioration of the symptoms takes place. But I have not met with success equal to that obtained by some others; and do not feel confident, from what I have seen, that a simple refrigerant treatment, without reference to the alkalizing of the blood, would not prove equally efficient.*

* See a paper by Dr. John B. Chapin in *N. Y. Med. Times* (iii. 385, Aug., 1854), detailing the results obtained by Dr. Swett in the N. York Hospital, and another by Dr. John T. Metcalfe, in the same journal (v. i. October, 1855), giving an account

From its property of rendering the urine alkaline, it may be advantageously employed in cases attended with excessive deposition of the urates in the urine, whether gouty, or without such complication; supposing an indication to exist at the same time for an aperient.

The dose as a laxative is from two to four drachms, for full cathartic effect not less than an ounce; care being taken that the salt is dissolved before being administered.

The *Seidlitz powder*, of which the Rochelle salt constitutes the basis, is a preparation much employed as a gentle aperient. It consists of one powder, containing two drachms of this salt and two scruples of bicarbonate of soda in one paper, and another powder of thirty grains of tartaric acid in another paper. The two powders are dissolved separately, the former in about two fluidounces of water, the latter in one fluidounce; and the solutions are then gradually mixed, and taken in the state of effervescence. The tartaric acid unites with the soda of the bicarbonate, of which the carbonic acid escapes, producing the effervescence; and the medicine, as taken, is a mixture of the tartrate of potassa and soda, with tartrate of soda. It is an excellent refrigerant laxative, peculiarly adapted to cases in which the stomach is delicate or irritable. The powder may be repeated every four or five hours till it operates; and sometimes advantage will accrue, in cases of great irritability of stomach, or in children, from giving fractions of a dose, repeated more frequently. In such a case, when the powders cannot be duly divided by weight, the object should be effected by dissolving each powder in a certain number of measures of water, and mixing one or an equal number of measures from each solution. To render them more agreeable to the taste, one of the solutions may be sweetened and aromatized before they are mixed.

VI. TARTRATE OF POTASSA.

POTASSÆ TARTRAS. *U. S., Lond., Ed., Dub.*

Syn. Soluble Tartar.

Preparation and Composition. Soluble tartar is made by saturating the excess of tartaric acid in the bitartrate of potassa, by means of

of nineteen cases of acute rheumatism under his own care in the same hospital, and sixteen others under the care of Drs. Griscom and Bulkley, in all thirty five cases, of which only two were not benefited by the treatment.

carbonate of potassa; the same plan of proceeding precisely being followed as in the preparation of the preceding salt. One equivalent of the bitartrate is thus converted into two of the tartrate, which consists of one equivalent of tartaric acid and one of potassa, without water of crystallization.

Properties. Instead of being allowed to crystallize, as directed in the U. S. formula, the solution is generally evaporated to dryness: the salt being stirred towards the close of the process, in order to cause it to granulate. Hence, as found in commerce, tartrate of potassa is almost always in the form of a powder, more or less granular. When crystallized, it has the shape of irregular hexagonal prisms with dihedral summits. In either form, it is white, inodorous, of a saline, bitterish, and very disagreeable taste, very soluble in water, nearly insoluble in alcohol, and deliquescent on exposure to the air. When heated to redness it evolves the odour of caromel, and is converted into carbonate of potassa, which is left behind with charcoal.

Incompatibles. Tartrate of potassa is decomposed by most of the acids and acidulous salts, which reconvert it into the bitartrate by taking half of its base. Its solution yields precipitates of insoluble tartrates with the soluble salts of lime, baryta, and lead.

Medical Properties and Uses. This salt was known in pharmacy about two centuries since, and was formerly more used than at present, having been superseded by others more energetic and less unpleasant. It has the ordinary properties of the saline cathartics, and may be employed for the same purposes. Like the Rochelle salt, it has the property, when taken in small and repeated doses, of rendering the urine alkaline. It has also the property of diminishing the griping effect of senna, and has been especially recommended as an addition to the infusion of that cathartic. The dose as an aperient is from one to four drachms, as a purge from half an ounce to an ounce.

VII. PHOSPHATE OF SODA.

SODÆ PHOSPHAS. *U.S., Lond., Ed., Dub.*

Preparation and Composition. In the preparation of this salt, bones are first calcined, and then treated with sulphuric acid and a little water. The acid takes the greater part of the lime of the phosphate of lime of the bones, forming the insoluble sulphate of

lime, and leaving the remainder combined with a great excess of phosphoric acid, in the state of a soluble superphosphate of lime, which is dissolved out of the mass by boiling water. To the solution of superphosphate of lime thus obtained, after due concentration, a hot solution of carbonate of soda is gradually added, so long as effervescence is produced. The carbonic acid of the carbonate escapes, and the soda, combining with the excess of phosphoric acid, forms a soluble phosphate of soda; while the neutral phosphate of lime to which the superphosphate has been reduced, being insoluble, is precipitated. The liquor being filtered while hot, deposits, on cooling, the phosphate of soda in crystals. The salt obtained is the tribasic phosphate, consisting of one equivalent of acid, two of soda, one of basic water, and twenty-four of water of crystallization.

Properties. Phosphate of soda, when recently crystallized, is in large, finely transparent, oblique, rhombic prisms, which, however, rapidly effloresce on exposure, and become white and opaque. It is inodorous, and has a pure saline, not disagreeable taste, very similar to that of common salt, though much feebler. It is soluble in four parts of cold and two of boiling water, and is nearly insoluble in alcohol. In consequence of its efflorescence, it gradually becomes stronger, in the same dose, if exposed to the air; and, as the water of crystallization amounts to nearly two-thirds of the weight of the crystals, it is obvious that the degree to which the efflorescence has proceeded should be considered in regulating the dose. When heated moderately, the crystals melt, and give out their water of crystallization; and, if the heat be pushed to redness, part also with their basic water, being converted into a white mass, which is the *pyrophosphate of soda*. When thus dried, the salt loses 62.3 per cent. of water.

Incompatibles. Phosphate of soda is incompatible with the soluble salts of lime, and with most of the neutral metallic salts, forming insoluble phosphates with the bases.

Medical Properties and Uses. This salt was first introduced into use as a medicine, by Dr. George Pearson, of London, about the beginning of the present century. It has all the general properties of the saline cathartics, though less efficient than some of them. Its chief recommendation is its simple saline taste, which enables it to be taken, when the other salts might be rejected, and even to be administered to a patient without his own knowledge, by substituting it for common salt. The condition, then, under which it is specially indicated, is the existence of an insuperable aversion of

the patient, or an obstinate resistance of the stomach to the ordinary saline cathartics, when these are called for by the symptoms of the case.

Possessing, in its phosphoric acid, a material essential to the constitution of the system, it has been theoretically supposed that it might be advantageously used in affections characterized by a deficiency of that material, such as mollities ossium, rickets, disordered nutrition with deficiency of the phosphates in the urine, and scrofulous and tuberculous disease, in which a similar deficiency is supposed to exist in the tissues. But, when it is considered that, in all such cases, if the deficiency really exist in the organic structures, it is not from a want of a sufficient supply of the material, which is always abundantly offered in the food, but from a defective power of assimilation, it will be readily admitted, that the failure of experience to confirm these favourable expectations is nothing more than might have been anticipated. The probability is, that the phosphate of soda is capable of answering the purposes to which the saline cathartics generally are adapted, and nothing more.

The dose of the salt is one or two ounces; the proportion of water being so great, as to render the real amount of saline matter in the crystals relatively small, and the dose consequently larger than of most other medicines of the class. It is said that a dose of it may be given dissolved in a bowl of soup or gruel, and the patient not be aware that he is taking anything more than common salt with his food.

VIII. SOLUTION OF CITRATE OF MAGNESIA.

LIQUOR MAGNESIÆ CITRATIS. *U. S.*

Preparation. Though the solid citrate of magnesia may be prepared without difficulty by a direct combination of its constituents, yet it has not been introduced into any officinal code, nor indeed into extensive use; a preference being given to the liquid form, in which the accessaries of the preparation, as officinally directed, recommend it strongly to a squeamish taste and delicate stomach.

According to the directions in the second edition of the U.S. Pharmacopœia of 1850, the solution is prepared by dissolving magnesia in an excess of solution of citric acid; filtering into a strong glass bottle of the capacity of twelve fluidounces, into which a

portion of syrup of citric acid had been previously introduced; then adding a little bicarbonate of potassa, with sufficient water nearly to fill the bottle, which must be tightly corked, and secured by twine; and lastly, shaking occasionally till the bicarbonate is dissolved. The first liquid introduced into the bottle, after the syrup of citric acid intended to give an agreeable flavour to the preparation, is a solution of citrate of magnesia with an excess of citric acid, which excess reacts upon the subsequently introduced bicarbonate of potassa, producing a portion of citrate of potassa, while the separated carbonic acid is retained in the liquid, and renders it brisk and effervescing. The preparation, therefore, is simply a solution of citrate of magnesia, with a little citrate of potassa, in water impregnated with carbonic acid, and agreeably flavoured. The substitution of bicarbonate of potassa, at the close of the process, for the carbonate of magnesia formerly employed, is to render the liquid clear: and the resulting citrate of potassa is of no injury to the preparation.

Properties. The solution of citrate of magnesia thus prepared is a colourless liquid, effervescing when poured out of the bottle, and of an agreeable acidulous taste. When long kept, it is apt to deposit an insoluble form of citrate of magnesia, and to be weakened proportionably. The citrate of magnesia contained in the solution is probably the tribasic citrate, consisting of one equivalent of acid and three of base; and the quantity in each bottle is about an ounce of the anhydrous salt. A similar preparation may be made by dissolving the solid citrate in water, flavoured with lemon syrup, and then introducing, from the fountain, as much carbonic acid water as may render the solution sufficiently effervescent.

Medical Properties and Uses. This is an elegant aperient, having the usual properties of the saline cathartics, and in large doses capable of operating efficiently. It is, however, incapable of supplying the place of sulphate of magnesia as an antiphlogistic remedy, and should not be substituted for it in cases requiring energetic treatment. But, when the object is simply to evacuate the bowels, and at the same time produce a moderately refrigerant effect, it may be employed with propriety, in all cases in which its excess of acid may not be contraindicated. It is peculiarly adapted to cases in which the stomach is very delicate or irritable, and is usually preferred by patients to any other saline cathartic, on account of the agreeable taste. For full purgative effect, the whole contents of a

bottle containing twelve fluidounces are required; but as an aperient simply, one-half, or one-third of the quantity will generally be sufficient. When the contents of the bottle are only partially removed, it should be immediately well corked, and kept in an inverted position, standing upon the cork.

c. *Mercurial Purgatives.*

Most of the mercurial preparations will occasionally act on the bowels; but only two are habitually used for the purpose, namely, *calomel* and the *mercurial pill;* and of these, only the former can be strictly considered as belonging to the cathartics; the latter being very seldom administered, with a view to its action on the bowels, except in connexion with some one or more of the more certain cathartics, which are necessary to secure its effect. We may, therefore, confine ourselves to the consideration of calomel, and of this simply as a cathartic; as upon all other points it has been fully considered already, or will be hereafter.

MILD CHLORIDE OF MERCURY or CALOMEL.

HYDRARGYRI CHLORIDUM MITE. *U.S.*—HYDRARGYRI CHLORIDUM. *Lond.*—CALOMELAS. *Ed., Dub.*

EFFECTS.—In a dose varying from five to twenty grains, calomel generally operates briskly as a cathartic, producing copious bilious stools, which, when the dose has been somewhat large, are usually of a dark brown colour, often approaching to black, though yellow in thin layers, and of a peculiar characteristic odour. In smaller doses, the medicine acts as a laxative; and the stools, instead of being dark, are now, for the most part, of a bright bilious yellow. In some instances, especially in children, they are green. It is not difficult to explain these different appearances. When the bile is eliminated in moderate excess, by small doses of the medicine, it has its normal colour of yellow. When produced in great excess, under a powerful stimulus to the liver, it is dark-brown, in consequence of the concentration of its colouring matter, but becomes yellow if diluted, or viewed in thin layers by transmitted light. If it meet with an acid in the bowels, it is rendered green, and this is particularly apt to be the case in children.

The purgative action of calomel is usually slow. If taken at bedtime, it will frequently not operate until morning; and gene-

rally from five to eight hours elapse before any decided effect is experienced. In most cases, its operation is sufficiently easy, with little or no inconvenience to the patient; but frequently a little nausea and griping pain are felt, about the time that purgation commences, or a little before. It very rarely produces any immediate evidence of irritation of stomach.

But, though thus efficient and generally moderate, it is, in a relatively few instances, very much otherwise. I do not now refer to those cases in which the medicine may be impure from contamination with corrosive sublimate, or may be administered with substances calculated to render it poisonous, as muriate of ammonia or nitro-muriatic acid. Given in this manner, it may be violently irritant in any case. But the instances I now have in view, are those in which the medicine is given in its perfectly normal state, and without improper accompaniment. This violent action of calomel is confined to a relatively few individuals, and is connected with constitutional peculiarity or idiosyncrasy, as it is the same with them under all circumstances. These persons have constitutionally a strong susceptibility to the purgative action of the medicine. The dose which, in most persons, operates kindly, occasions in them vomiting and purging of bile, with excessive nausea, and severe spasmodic pain in the stomach and bowels, in fact, a complete attack of cholera morbus, which, however, so far as I have observed, always subsides in a few hours, or may be checked by the administration of an opiate. In these same individuals, a small dose, as a grain, or even half a grain, will operate once or more on the bowels, producing bright bilious discharges, and with no great inconvenience, but still some griping pain, and feelings of nausea or sinking in the epigastrium. This peculiar susceptibility I have known to be hereditary. In all these cases, the unpleasant effects are not produced for several hours, proving that they are not the result of a direct irritant action of the calomel on the gastric mucous membrane, but arise probably from the bile thrown out into the duodenum.

A peculiarity of the purgative operation of calomel is, that it is not increased by an increase of the dose after a certain point. Up to that point, it obeys the general law of acting in proportion to its dose; but, when the quantity has been ascertained capable of producing the full cathartic effect, it may be almost indefinitely increased, without any or with very little increase of the discharges; and, indeed, the effect is sometimes lessened. It will be seen, when

we come to the consideration of the mode in which calomel acts as a purge, that this peculiarity can be satisfactorily explained.

Another interesting point is that neither this, nor any other preparation of mercury, is disposed to operate specially on the bowels when admitted into the system through the outer surface.

Occasionally, when taken as a purgative, calomel will salivate. This is not apt to happen when it operates well upon the bowels, and, therefore, occurs less frequently from large than small doses. But there are individuals peculiarly susceptible to the constitutional influence of mercury, who are always salivated by calomel in purgative doses, whether given alone or in combination with other cathartics. One of the worst cases of ptyalism I ever witnessed was produced by eight grains of calomel, given as a purge to a female affected with erysipelas. For such persons mercurials should be prescribed with the greatest caution, and never except in very small doses.

Children require much larger doses of calomel as a purgative, proportionably, than adults. A quantity which will generally operate readily on a grown person, will often scarcely act on a child two years old, unless aided by other cathartics. Generally speaking, calomel acts mildly, though effectually, on children. In a very few instances, when it has failed to purge, I have known it to produce a slight ptyalism in infants; but this is extremely rare. In two or three cases, it has seemed to me to be the cause of ulcers in the mouth, in children from one to three years old, when due caution was not observed to secure a purgative effect by the subsequent administration of castor-oil; but the ulcers healed without difficulty, and no evil resulted. As to the fears entertained of deformity of the limbs, spinal disease, white swellings, &c., I believe they are quite chimerical. It is highly probable that these affections have occurred in children to whom a dose of calomel had once been given; but they might as justly be ascribed to a dose of magnesia, or rhubarb, or castor-oil, or even more justly to the milk of the mother, which the child takes every day. Out of hundreds of infantile cases, in which I have seen calomel purges administered, I have in no one instance known of any permanent injury.

Mode of Operating.—In itself, calomel can scarcely be considered as irritant. This would seem to be a necessary consequence of its insolubility. Hence its want of acrid taste, and the absence of all evidence of irritation, for some time after it has been taken into the

stomach. The probability is that, simply as calomel, it is perfectly bland when in contact with the alimentary mucous membrane. But, in consequence probably of the presence of chlorides in the contents of the canal, it slowly forms small portions of the soluble double chlorides of mercury and the alkaline metals, as shown by Mialhe (see *page* 291), which are sooner or later absorbed, but, while still in the canal, must prove somewhat irritant to the mucous surface. It is not impossible that calomel may in this way, in some degree, act as a cathartic; but I believe that its influence on the bowels depends chiefly on another cause.

It is very rare that the stools produced by calomel are not highly bilious: and the most probable view of its purgative action is, I think, that the bile which it causes to be poured into the duodenum is the real purgative. We know well that an excess of bile in the bowels, resulting from morbid causes, purges, and not unfrequently also vomits, as in bilious diarrhœa and cholera morbus. Its presence in the same place, under the influence of calomel, must be followed by the same results.

It is an interesting question how calomel acts in producing this increase of the bilious secretion. Some suppose that it is merely by irritating the orifices of the biliary ducts, and the neighbouring mucous membrane, upon the general principle, that an irritation of the surface, upon which the outlet of a gland opens, causes an increased action of the gland, as food in the mouth causes an increased flow of saliva. But, if this were the true mode of action, other irritants should have the same effect; and gamboge, elaterium, and other drastics should be more powerful cholagogues than calomel; whereas it is very doubtful whether they produce any specific effect whatever on the liver. A much more reasonable supposition appears to me to be, that the calomel, as fast as rendered soluble in the stomach and bowels, is taken up by the radicals of the portal veins, and thus conveyed immediately to the liver. It has been proved, by experiment, that foreign substances in the stomach and bowels find a much more ready entrance into the circulation, through the portal veins, than through the lymphatics or lacteals; and there can be little doubt that this is the case with the mercurial. Distributed, then, through the liver, and brought into immediate contact with the cells of the acini, it excites these to increased action, and thus produces the great excess of bile characteristic of its operation.

We can thus account for the fact that calomel is much less apt to salivate when it purges. It might be supposed that this was

owing to the discharge of the calomel itself from the bowels, and, no doubt, this is one cause; but I believe a stronger is that, when absorbed and conveyed into the liver, it is thrown off by the secreted bile, and thus prevented from gaining access to the system. When the liver does not respond to this influence, either from the minute amount of the mercurial absorbed, or from its own insusceptibility, the medicine passes onward into the general circulation, and affects the system. When calomel does not purge, there is a want of responsive action of the liver, and hence it often salivates. Some persons are not readily purged by the medicine, but are proportionably more easily ptyalized; others are purged very readily, and by minute quantities; and I have noticed that it was unusually difficult to bring the systems of the latter persons under the influence of mercury given by the mouth.

The excessive susceptibility occasionally exhibited to an irritant influence on the stomach and bowels, already alluded to, may be readily explained upon these principles. In these cases, it may be remembered that the irritation is not felt until several hours after the medicine has been taken. This would not be, if the irritation were direct on the mucous membrane. When the vomiting, purging, and spasmodic pains come on, the matters discharged are highly bilious, and the phenomena almost precisely like those of severe bilious diarrhœa or cholera. It is thus the acrid bile that produces the irritation. The fact, then, appears simply to be, that, in these persons, the liver is extremely sensitive to the action of the absorbed mercurial, so that a quantity which, in an ordinary individual, would in no degree sensibly affect the secretory function, in them acts on it powerfully. I have already stated that half a grain of calomel will in these persons almost always act as a laxative, with bilious stools; and it is in patients of this kind, that I have repeatedly failed in any attempts at salivation through the alimentary canal.

We can also, upon this principle, understand why the mercurials, applied externally, do not as a general rule purge. The medicine, upon entering into the circulation, does not pass through the liver, and reaches that organ only as it does all other parts of the body, through the arteries. The quantity, therefore, carried into the liver is insufficient materially to affect its secretory function; which, moreover, may be less responsive to excitants reaching it through the general circulation, than to those brought to it by the portal vein, which probably supplies it mainly with material for secretion.

Another important fact is explicable upon the principles here laid down. It has been stated that, beyond a certain dose of calomel, which, however, may vary for different individuals, and for the same individual at different times, an increase of the medicine is not attended with an increase of effect. Thus 10 or 15 grains will act as vigorously as a drachm, or an ounce. It will be recollected that only that portion of the calomel which is dissolved in the alimentary canal really operates; whether by a direct action on the membrane, or through the liver by absorption. Now the quantity dissolved is limited, as proved by Mialhe, by the amount of the chlorides present in the canal. If this is small, no matter how large the dose of the calomel, the effect will be small; if large, the effect will be proportionate to the quantity, until the whole converting power of the chlorides is exhausted, after which the calomel becomes inert. Thus, if there are any chlorides present, a small dose of calomel will operate to the full extent of its quantity; while a larger quantity will be limited in its effects by the amount of chlorides; and as these may be supposed to differ in different persons, and in the same person at different times, it is understood how the greatest effect of the calomel must also vary.

The comparative insusceptibility of children to the purgative operation has been explained in the same way. It is supposed that, from the character of their diet, or other cause, there is apt to be less of the chlorides in their stomach and bowels than in those of adults. There is consequently less of the calomel rendered soluble, and proportionably less purgative action.

Poisonous Effects.—Much has been said of the poisonous effects of calomel. In numerous instances, even in moderate doses, it is asserted by some writers to have produced the most alarming symptoms, and sometimes to have occasioned death; and, in very large doses, has been accused of exercising the most murderous powers. Yet authorities more numerous, and quite as authentic, can be adduced in favour of its harmlessness in large quantities; and, in this country, every practitioner knows that it has been given in doses of a scruple, a drachm, several drachms, an ounce even, by adventurous practitioners, without obvious injury. I have been told of one case of acute disease, in the course of which a pound was employed, without any reason to suppose that it hastened the fatal issue. Cannot these discrepancies be reconciled? The reader who has attentively perused the preceding observations upon the effects and mode of action of calomel, is I think furnished

with a clue which may lead him out of this labyrinth of contradictions. I have not the least doubt, that much of what has been said on the injurious effects of calomel has been the result of partial or prejudiced observation, often ascribing the consequences of disease, or merely accidental coincidences from other causes, to the use of this remedy. I cannot but think so; because, in the course of a practice extending through a period of nearly forty years, during which I must have prescribed calomel, and seen it prescribed to thousands, I cannot recall a single instance, within my own personal experience or observation, not only of any fatal effect, but of any serious permanent injury from its use. Yet nothing is more certain than that fatal effects have sometimes been produced by it; that, in a large number of cases, it has brought patients into states of greater or less danger; and that, in a few of these, there has been left behind, after recovery, serious deformity of the face, and perhaps other permanent injury. It will be understood that I am here considering calomel as employed in purgative doses, and without a view to its systemic effects, of which enough has been said under mercury as an alterative.

When calomel has produced *dangerous or fatal irritation or inflammation of the alimentary mucous membrane*, the result may be ascribed either 1. to its containing a considerable proportion of corrosive sublimate, 2. to its being administered shortly after, or at the same time with muriate of ammonia, nitromuriatic acid, or other agent capable of rendering it soluble in the gastric liquids, or 3. to the accidental presence of a large and abnormal quantity, in the stomach and bowels, of the alkaline chlorides, under circumstances favourable to the rapid chemical change in the calomel, already referred to. It is obvious that it is the last only of these sources of injury that may not be avoided with due care; and even this is so rare an event, if we are to decide upon the grounds of experience, that no injury need be apprehended, with a moderate observance of the ordinary rules of prudence. The change is effected slowly by these agents as they exist in the stomach and bowels, and, if proper attention is paid to the warnings given in any particular case, all danger may be avoided by free purgation with castor oil or sulphate of magnesia. I do not here consider the danger of hypercatharsis, to which every patient of an ignorant or reckless practitioner is liable, from an abuse of this, as of any other energetic purgative.

Another danger from calomel is that, instead of operating upon the bowels, it may violently affect the system, and operate destruc-

tively through excessive inflammation of the mouth and neighbouring parts, or great disturbance of the vital functions. This is, I believe, a much more serious source of evil than the preceding. No practitioner who uses calomel at all as a purgative is absolutely secure against these results; for the susceptibility in some individuals is so great, that the smallest quantity ever used with a view to cathartic effect, may induce in them severe ptyalism. Yet, with due caution, not only in the use of the medicine, but in making inquiries as to the constitutional peculiarities of individuals in this respect, the danger is so diminished as to be almost infinitely small; and it should not be allowed to weigh, for a moment, against the great benefits to be derived from the medicine.

The question now suggests itself, whether the use of calomel, in the large doses referred to, is compatible with this due caution. I think it is not. Nothing is more true than that they are often given with entire impunity, especially in those diseases of the stomach and bowels for which they have been most frequently prescribed. The reason of this impunity is obviously, that only a small proportion of the calomel really acts, the other being entirely inert as regards any dynamic operation, and equivalent only to as much inert powder of any other kind, having the same physical qualities. The portion of the calomel which operates is only that which is rendered soluble, and this is limited by the amount in the stomach and bowels of the reagents calculated to render it soluble. Now, as a general rule, there is not enough of these to do more than to enable a full dose of calomel to act on the bowels vigorously; and as a general rule, therefore, there is no danger of serious gastro-enteritis. Moreover, still speaking in a general way, the change in the calomel which fits it for absorption is so slow, as not to endanger serious mischief, even though the calomel should not happen to be rapidly carried off by purgation. But there are exceptions to these general rules. There may happen to be chemical agents enough in the bowels to react on much more than the ordinary amount of calomel, and convert it into a powerful irritant; and there may happen also to be an excessive susceptibility to the constitutional impression. There will, therefore, be occasional danger, from these large doses, of serious gastro-enteritis, or hyperemesis and hypercatharsis, or of a dangerous action on the mouth or the vital functions. This risk should never be incurred, unless for some highly important, and otherwise unattainable end; and it is extremely doubtful, in my mind, whether disease offers to us any

occasion of this kind. Induced by these considerations, I have never employed the excessive doses of calomel recommended by some writers, and would not advise their employment under any circumstances by others. There will be occasion to say more upon this point, when treating of the use of large doses of calomel in dysentery and cholera.

THERAPEUTIC APPLICATION.—Calomel is peculiarly indicated as a purgative, whenever, in connexion with any other call for cathartic medicine, there is an indication for stimulating the secretory function of the liver. This indication is presented in diseases attended with torpor of the liver, general portal congestion, or congestion of the liver itself, and by those, moreover, in which it may be desirable to deplete from the portal circulation, though not congested, or to act revulsively towards the liver for the relief of inflammation or congestion elsewhere.

Bilious remittent and *yellow fevers* often offer the indication, especially at the commencement; the former being very often and almost characteristically associated with congestion of the liver, the latter with almost complete atony of the organ. A full purgative dose of calomel, therefore, or of some cathartic compound containing it, is generally administered as the commencing step in the treatment of these complaints; and, in the course of them, it may sometimes be advisable to repeat the dose, when the same conditions exist; though the end is in general better attained, in the latter case, by the use of smaller doses of calomel or blue pill, followed by sulphate of magnesia, or other gentle cathartic. The *miasmatic intermittent* may also be advantageously treated in the same way, whenever the disease may appear to be complicated with similar conditions of the liver.

Under the name of *bilious disorder*, there often occurs, in the hot seasons, an affection of the digestive organs, characterized by uneasiness of the stomach, defective appetite, sometimes nausea, a furred tongue, general uneasiness, and often apparently causeless dejection of spirits. The eyes not unfrequently have a sallow tinge, and the bowels are torpid, or the discharges are light-coloured, or dark, indicating defective or deranged action of the liver. Full mercurial purgation will generally entirely relieve this affection, and probably prevent the occurrence of some more serious attack, as bilious colic, cholera morbus, dysentery, or jaundice.

In all cases of *constipation*, with deficiency of bile in the passages,

a purgative dose of calomel may be given. This condition often precedes an attack of jaundice, which may thus be prevented.

In *jaundice itself*, of the ordinary kind, attended with clay-coloured passages, and bilious urine, a purgative dose of calomel, alone or combined, should be given at the commencement, and occasionally repeated in the course of the disease.

Acute hepatitis generally offers the same indication. Where a purgative is required, calomel should almost always be used, either alone, or connected with other cathartics. In the chronic variety, active purgation is seldom desirable, and it is rather the alterative than the cathartic action of the medicine that is wanted.

In *acute splenitis*, calomel should be given at the outset, with a view to deplete from the portal circle, so intimately connected with that organ.

Dysentery, in its severer forms, presents the same indication most decidedly. There is usually deficient secretion of bile in this disease; depletion from the portal circulation is strongly called for; and a derivative influence from the colon and rectum to the liver, through the portal vein, is a not less obvious want in the case. Hence, calomel has generally been deemed a most important remedy in this disease, and, in its worst forms, there are few if any more effective. In cases of only moderate severity, the ordinary dose of the mercurial may be sufficient; but, in the worst forms, a large dose of fifteen or twenty grains may be given at first, and the medicine may be repeated in smaller doses afterwards. Should it salivate, it will be all the better.

In *bilious colic*, calomel is strongly called for by the congested state of the liver, and, in connexion with opium, is the most important remedy in the disease. It should be given immediately. From two to four grains of opium, with from six to twelve grains of calomel, may be administered in divided doses at short intervals, until the pain is relieved, and then followed by castor oil, sulphate of magnesia, or infusion of senna with that salt, so as to secure efficient action on the bowels. *Colica pictonum* may be treated in the same way.

In *gastritis*, *severe enteritis*, and *peritonitis*, calomel may often be advantageously used as a cathartic, at the commencement of the disease. To *gastritis* it is adapted, because among the least irritant of cathartics to the mucous membrane, and the one most likely to be retained on the stomach. In *enteritis*, particularly of the variety which affects the whole thickness of the bowel, or at least extends to

the muscular coat, and thus induces constipation, it is recommended by the same advantages. In both, as well as in *peritonitis*, it also operates usefully by depleting from the portal circle, and at the same time operating revulsively to the liver. In all these cases, it should be given either uncombined, or in connexion with opium; and may be followed in due time, should it not operate, by one of the quicker of the mild cathartics, as castor oil, or sulphate of magnesia.

In *infantile diseases*, calomel is peculiarly efficacious. It is recommended here by its want of unpleasant taste, by its retention upon the stomach when others are rejected, and by the general mildness of its operation. It is useful, moreover, in the complaints of children, in some way which I cannot explain, and altogether independently, so far as I can judge, of any action upon the liver. Upon this point, my experience scarcely permits me to doubt. I have often seen the diseases of children yield promptly to a dose of calomel, which have refused to yield to other cathartics. In their irritative fevers, cephalic affections, pectoral inflammations, verminose complaints, and various disorders of the bowels, calomel will often act most happily. In children more than a year old, it may be given whenever an indication exists for active purgation, and no special indication is presented for some other cathartic. Some apprehend great evils from it, and shun it most religiously in these cases. I cannot conceive the grounds of their fears. At least, I can say most truly, that I am not aware that I have ever seen it do serious harm. It should, however, never be allowed to remain long in the bowels without acting; but always, if it do not operate in six or eight hours, be followed by castor oil, or other quick and mild purgative. A good plan is to give it late at night, and to administer the other cathartic early in the morning if required. The calomel is best administered uncombined.

Employment as a Supposed Sedative. In *epidemic cholera*, *dysentery*, *yellow fever*, &c., it has been recommended in large doses as a sedative agent. It is asserted that, when given very largely in these cases, so far from causing local or general excitement, it produces, on the contrary, a remarkable sedative effect, allaying the local irritation, checking vomiting and purging, lowering the frequency and force of the pulse and the heat of skin, and greatly contributing to the cure. As to the quantity administered, there have scarcely been any fixed limits; and experiment has run wild, in the latitude of choice, which, according to this theory, is permitted to the adventurous practitioner. The old doses have been quite disregarded. Twenty grains every half hour, hour,

or two hours have been quite within bounds, in cases of epidemic cholera. Two drachms at the beginning, and a drachm every hour or two afterwards, have been given; and an instance is recorded, in which thirty drachms were administered in 48 hours, with moderate ptyalism and recovery; and fifty-three drachms in 42 hours, in a fatal case, without observable effect. (Pereira, *Mat. Med.*, 3d ed., p. 854.) In this country, the remedy has been used in teaspoonful doses; and I have before mentioned an instance, in which a pound is said to have been given in the course of the disease. I have never used calomel in this method, and can say nothing in regard to it of my own knowledge. Why it is generally safe, the reader can understand. Perhaps only from ten to twenty grains act dynamically; all the rest is inert. But it does not follow, that this inert portion may not be operating advantageously by its physical properties. It is not impossible that, diffusing itself over the mucous surface, adhering everywhere to the villi, and filling up the follicles, it may form a protective coating for the tender surface, which may guard it against the irritating contents of the bowels, as a piece of caoutchouc, or gutta percha plaster, will protect an external inflamed surface, and thus favour the subsidence of the inflammation. Its presence and weight may also interfere with and depress the function of the irritated part, and thus check the excessive secretion. Upon similar principles, it is thought that subnitrate of bismuth restrains diarrhœa, and indeed cures the complaint. All this may be true; but I doubt whether the advantage gained is equal to the hazard. Some may be benefited; many may be unaffected, neither receiving good nor harm; but there may be some, as before suggested, to whom, under certain circumstances, the measure may do irreparable injury; and, unless we had more satisfactory evidence of a good effected which could be attained in no other way, it would be the part of prudence not to imitate the practice.

Administration. The dose of calomel for an adult is from five to twenty grains; for a child two or three years old, about four grains. One or two grains may be given to infants under a year. It may be administered in powder, mixed with syrup or molasses, or in the form of pill, which should be freshly made, so as to be readily broken up in the liquids of the stomach. Should it not operate in six or eight hours at furthest, it should be followed by another cathartic, as castor oil, one of the saline purgatives, or senna, to hasten its action. To insure its operation, and increase the purgative effect, it is not unfrequently given in combination with other cathartics, as

rhubarb, aloes, jalap, scammony, compound extract of colocynth, &c. It is one of the ingredients of the *compound cathartic pill* of our Pharmacopœia, which may often be advantageously employed in the diseases above mentioned, when calomel is indicated. But in all cases in which the stomach is irritable, the calomel should be given alone.

3. *Drastics, or Drastic Purges.*

I. SCAMMONY.

SCAMMONIUM. *U.S.*

Origin. Scammony is the concrete milky juice of the root of *Convolvulus Scammonia*, a climbing perennial plant of Syria and Asia Minor, with a long tapering root, and numerous slender, twining stems. In the collection of scammony, the root is cut off obliquely near the top, and the juice, as it exudes, received into small shells, whence it is transferred into some convenient receptacle, in which it is allowed to harden. In the course of concretion, it probably undergoes a slight fermentation, attended with the production of minute bubbles of air throughout its substance, which it retains when it becomes solid. Very little, however, of the pure concrete juice is sent into the market. It is almost always more or less mixed with foreign substances, as meal, chalk or other form of carbonate of lime, gummy matter, an extract prepared from the plant, &c. This admixture is made partly by the peasants who collect the scammony, partly after it has been brought into the market of Smyrna; and, in the latter place, the adulteration is carried on according to a regulated plan, the amount of impurity being graduated inversely to the price. Formerly, the better kinds were sold under the name of *Aleppo scammony*, from the town in the vicinity of which the drug was collected; and the inferior kinds under that of *Smyrna scammony*, from the place of export; but this distinction has been abandoned, as it no longer applies to the drug existing in the markets; almost the whole that is used, the better as well as the worse, coming from Smyrna.

Properties. Scammony is in two distinct forms, one of which, supposed to be tolerably pure, is called *virgin scammony*, the other, in which there is almost always more or less admixture of impurities, may be denominated *common scammony*.

Virgin scammony is in irregular lumps, grayish on the outside,

easily broken, with a fracture somewhat shining, resinous, and of a greenish-black colour, or grayish-green becoming black on exposure, and translucent at the edges. Examined by a magnifying glass, it is seen to be full of minute air-cells.

Common scammony is in circular cakes, flat on both sides, or plano-convex, from four to six inches in diameter, and from half an inch to two inches thick, of different colour in different specimens, some being of a light greenish-gray, others ash, or olive, or slate-coloured, and sometimes almost black. This variety is compact, heavy, hard, finely porous, with a fracture generally more or less shining, though sometimes dull, of a grayish colour, becoming darker on exposure, and with translucent splinters.

Both kinds yield a light-gray powder. The smell is feeble, but somewhat like that of old cheese; the taste very slight at first, but becoming acrid after a time, and slightly bitterish.

Composition. Scammony is essentially a gum-resin, with some other unimportant ingredients. It yields the gum to water, the resin to alcohol or ether, and both to diluted alcohol. Rubbed up with water, it forms a milky emulsion. The activity of the medicine resides exclusively in the resin, the proportion of which differs very much in the different specimens; amounting to 90 per cent. in the purest scammony; but, in that to be found in the market, varying from 80 down to about 40 per cent., and, in the greatly adulterated specimens, sinking to 10 per cent. or lower. The proportion of resin may be considered as a test of the strength and purity of the drug. The adulteration with meal may be detected by the blue colour imparted by the starch to iodine; that with carbonate of lime, by effervescing with muriatic acid.

Substances have been sold as scammony which were derived from other plants, or entirely *factitious*, being made up of materials not existing in the genuine drug. One of these, often designated as *Montpellier scammony*, is said to be prepared, in the South of France, from the juice of *Cynanchum monspeliacum*. They are now, probably, not to be found in our shops.

Medical Effects and Uses. Scammony has been employed from the earliest records of medicine. It is an energetic, hydragogue cathartic, generally producing more or less griping when it operates, sometimes acting harshly, and, in over-doses, capable of producing dangerous inflammation of the gastro-intestinal mucous membrane. It is probable that the gum qualifies the harshness of the resinous ingredient, by involving its particles, and thus mecha-

nically preventing their full effect on the surface of the membrane; and some of the additions made to it, in its place of production, viewed in the same light, though they render a larger dose of the medicine necessary, may prove serviceable by moderating its violence. Scammony is seldom administered alone, but generally with other cathartics, to give them increased energy or rapidity of action. It is occasionally combined with calomel; but is probably most used as an ingredient of the *compound extract of colocynth*, and consequently of the *compound cathartic pills*, of which that extract forms a part. It may be employed whenever an energetic purgative is required, and there is no irritability of stomach, or gastric or intestinal inflammation. Its griping may be obviated, in some degree, by giving aromatics at the same time.

Administration. The dose of virgin scammony is from 5 to 15 grains, that of the common kind, from 10 to 30 grains. The medicine is best administered in emulsion, made by rubbing it up with gum arabic or almonds, sugar, and one of the aromatic waters. There are several officinal preparations.

Compound Powder of Scammony (PULVIS SCAMMONII COMPOSITUS, *Lond.*, *Ed.*, *Dub.*) is made differently by the different British colleges; the London preparation consisting of scammony, extract of jalap, and ginger; the Dublin, of scammony and compound powder of jalap (consisting of jalap, cream of tartar, and ginger); and the Edinburgh, of scammony and cream of tartar. But such combinations are, I think, best left to extemporaneous prescription. The dose of these powders is from ten to thirty grains.

Confection of Scammony (CONFECTIO SCAMMONII) is a preparation of the London and Dublin Colleges, made by beating up powdered scammony with aromatic powders and syrup. The dose is from thirty grains to a drachm.

Alcoholic Extract of Scammony (EXTRACTUM sive RESINA SCAMMONII, *Ed.*) is directed, by the Edinburgh College, to be made by dissolving scammony in proof spirit, and evaporating the alcoholic portion of the menstruum. The resin is then deposited from the remaining watery portion, which is to be poured off, and the resin afterwards thoroughly washed with boiling water. Thus prepared, it is of a dirty greenish-brown colour, having, in a slight degree, the smell of scammony, and its acrid taste. It is soluble in alcohol, ether, and boiling hot diluted alcohol. The dose is from five to ten grains. The best form for exhibition is an emulsion made by rubbing it with unskimmed milk, in which its taste is quite lost.

II. COLOCYNTH.

COLOCYNTHIS. *U.S., Lond., Ed., Dub.*

Origin. Colocynth is the prepared fruit of *Citrullus Colocynthis* (Cucumis Colocynthis, *Linn.*), or *bitter cucumber*, an annual plant, with trailing stems, bearing considerable resemblance to the water-melon, growing wild in the islands of the Archipelago, and in various parts of Africa and Asia. The fruit, which is about as large as an orange, and yellow when ripe, is gathered in autumn, deprived of its cortical portion, and dried, before being sent into market.

Properties. The prepared fruit, as kept in the shops, is in globular balls, about two or three inches in diameter, extremely light, of a whitish colour, and composed of a soft, spongy, tough pulp, or medullary matter, and numerous seeds, which constitute about 75 per cent. of the whole weight. The spongy portion has a very feeble odour, and an intensely bitter, nauseous taste. The seeds also are bitter, but in a less degree; and, having comparatively little of the purgative property, should be rejected, when the colocynth is prepared for use. Both the bitterness and medical virtues of the pith are extracted by water and alcohol.

Active Principle. Colocynth owes its virtues to a peculiar, neuter, bitter principle, called *colocynthin*, which is intensely bitter, soluble in alcohol, less soluble in water, and precipitated from its aqueous solution by infusion of galls. This principle is not isolated for medical use. There are also in the pulp considerable quantities of pectic acid and mucilaginous matter, which cause the decoction or hot infusion to gelatinize on cooling.

Medical Effects and Uses. Colocynth is a powerful, drastic, hydragogue purgative, occasionally, even in ordinary doses, operating harshly, and capable, in over-doses, of producing violent irritation of the stomach and bowels, with severe griping pains, bloody stools, &c. It has in several instances caused death, through inflammation of the alimentary canal; and in one instance, mentioned by Dr. Christison, this result took place from a teaspoonful and a half of the medicine. The irritation and inflammation have extended also to the kidneys, bladder, and genitals, showing that the bitter principle is probably absorbed, and operates through the circulation. Colocynth is said sometimes to act as a diuretic, and, if given so that its bitter principle might be absorbed without

purging, it would be very likely to produce this effect. It is thought also to act on the liver, and by some to have a peculiar disposition to operate on the lower bowels, and I have little doubt, is tonic in minute doses. It seems, indeed, to bear some resemblance to aloes, in its mode of action, though much more hydragogue, and more powerful as a purge.

It is very seldom administered alone, but almost always in connexion with other cathartics, to which it gives increased activity, while its own violence is mitigated. In this mode, it is employed, in the full dose, whenever an energetic cathartic effect is demanded, and in small doses, as a laxative, in torpid conditions of the liver, and of the stomach and bowels generally. It is wholly unfit for cases in which the stomach or bowels are inflamed.

The dose of colocynth is from five to ten grains. When administered in pill or powder, the pulp should be thoroughly rubbed with gummy or starchy matter, so as to pulverize it well, and obtund its acrimony by separating its particles; and a little sulphate of potassa would be a good addition, with a view to a more thorough division and incorporation of the materials. The decoction and tincture, though active, are little employed, and not officinal in the U. States or Great Britain. The form in which colocynth is almost exclusively used, in this country, is that of extract; and the officinal compound extract is among the most popular of the cathartic preparations.

Compound Extract of Colocynth (EXTRACTUM COLOCYNTHIDIS COMPOSITUM, *U. S.;* PILULA COLOCYNTHIDIS COMPOSITA, *Lond., Dub.:* PILULÆ COLOCYNTHIDIS, *Ed.*) is prepared, according to the directions of our Pharmacopœia, by first exhausting colocynth by diluted alcohol, then adding to the tincture aloes, scammony, and soap, and lastly evaporating to the proper consistence, adding powdered cardamom near the end of the process. The preparation is thus seen to contain the virtues of colocynth, scammony, and aloes, with soap to give it due consistence, render the mass more soluble, and perhaps to qualify the drastic character of the more active ingredients, and an aromatic to obviate nausea and griping. The London *Compound Pill of Colocynth* differs mainly in the use of the extract of aloes instead of aloes itself, which is a doubtful improvement, and the watery instead of the spirituous extract of colocynth. The Edinburgh and Dublin preparations contain the colocynth itself in powder, which gives greater bulk to the mass. But all the officinal preparations may be considered as identical in effect. The prepa-

ration is much used, in small doses, as a tonic aperient, in constipation with a torpid state of the bowels, inactive hepatic function, or dyspeptic condition of the stomach. In the full dose, it is a powerful, yet sufficiently mild purgative, adapted to all conditions in which a full and effectual operation upon the bowels is required, whether in reference simply to the evacuation of the bowels themselves, or to a revulsive, or hydragogue effect. It is very frequently given in combination with calomel, in the complaints in which the latter cathartic is peculiarly indicated; and constitutes one of the ingredients of the *Compound Cathartic Pills* of our Pharmacopœia, now so extensively used throughout the country. Hyoscyamus is often combined with it, in order to correct any griping tendency, and is an excellent addition. Such a combination is officinal with the Edinburgh College, under the name of PILULÆ COLOCYNTHIDIS ET HYOSCYAMI, consisting of two parts of the extract and one of hyoscyamus, which may be given in about the same dose as the extract itself.

The dose of the compound extract of colocynth is from five to thirty grains. The medium full dose may be stated at fifteen grains, if the preparation be made from good materials. From three to five grains should operate as an aperient.

III. BLACK HELLEBORE.

HELLEBORUS. *U. S., Lond., Ed.*

Syn. Melampodium.

Origin. Black hellebore is the root (rhizome and fibres) of *Helleborus niger*, a small, herbaceous, perennial plant, sometimes, from its period of inflorescence, and the aspect of its flower, called the *Christmas rose.* The plant is a native of the hilly regions of southern and middle Europe, from the Archipelago on the one side, to the Bay of Biscay on the other. The root, as used in this country, is imported chiefly from Germany.

Properties. It consists of a blackish, or brownish knotted head or rhizome, very irregular in shape, half an inch thick or less, and several inches long, showing the remains of the leafstalks on its upper surface, with numerous dark-brown, radical fibres, cylindrical, about as thick as a straw, and from four to twelve inches long, which are sometimes attached to the sides and under surface of the rhizome, sometimes separate, and generally more or less broken.

The colour of the root is internally whitish; and, when one of the radicals is broken transversely, the pith appears somewhat stellate. By these characters, the root may generally be distinguished from those of other plants, which are said to be now frequently mixed with or substituted for it. The root has a very feeble odour, said to resemble that of seneka, and a taste, which, though slight at first, becomes bitterish, acrid, and nauseous. In the fresh root the taste is extremely acrid and burning; but the acrimony is diminished by drying, and very much impaired by time. Water and alcohol extract its virtues; which are much injured by long boiling.

Active Principle. Black hellebore contains a *volatile oil*, with which its acrimony is probably connected, in some measure at least, and upon the escape of which may possibly depend the diminution of the activity of the drug by drying and by time. There is also said to be an acrid fixed oil among its ingredients; and a peculiar principle has recently been discovered, called *helleborin*, which is white, crystallizable, bitter to the taste, with a slight tingling effect on the tongue, and neuter in its relations to acids and alkalies. (See *U. S. Dispensatory.*) How far this principle is connected with the medicinal activity has not, I believe, been ascertained.

Medical Properties and Uses. Black hellebore was long thought to be the celebrated hellebore of the ancients; but, at present, it is generally believed that the latter was the root of another species, the *Helleborus orientalis*, which has been found growing in the districts, where the plant used by the ancients is known to have been most abundant. In the recent state, the root is violently acrid, producing, when applied to the skin, inflammation and even blistering; but this property is much diminished by drying, and is lost by time. When taken internally, the medicine is a drastic hydragogue cathartic, with a disposition to stimulate the uterus, and therefore ranked with the emmenagogues. It is, however, uncertain in its operation, sometimes acting harshly in doses, in which, at other times, it produces little or no effect, and in over doses causing hypercatharsis, with vomiting, abdominal pains, cramps, and convulsions, which have sometimes ended fatally. This inequality of action probably arises, in part, from difference of susceptibility in the persons taking it, which seems to be common in relation to the ranunculaceæ, and partly from the great inequality in the strength of the medicine, in consequence of the deterioration it undergoes by keeping. Some suppose that its active matter is absorbed, and has a special disposition, like that of aloes, to act on the pelvic viscera. From the manner

in which it acts poisonously on the lower animals, it has been supposed to operate also specially on the brain.

The hellebore of the ancients had great reputation in the treatment of insanity, melancholia, and epilepsy; and was believed to operate usefully in these complaints through its purgative properties; but it is not impossible that the supposed narcotic influence may have had some instrumentality in the favourable results. The ancients used it also in amenorrhœa, dropsy, worms in the bowels, and affections of the skin. In this country, black hellebore is little employed, except, perhaps in amenorrhœa, in which it is supposed to be useful by a specific action on the uterus, independently of purgation. At one time I employed the medicine to a considerable extent, but found it so often quite ineffectual, and at all times so uncertain, that I long since abandoned the use of it altogether. My want of success with it may have been owing to the deteriorated character of the drug, in consequence of having been long kept in the shops. I can readily understand, however, that, in the countries where it may be obtained fresh, and of unimpaired powers, it may be a useful remedy in the complaints, in which its congener was employed by the ancients.

The dose of the root, with a view to full effect, is from ten to twenty grains. From three to six grains of it may be given as an alterative and aperient, in skin affections and portal congestion. A *decoction*, made by boiling two drachms in a pint of water, has been recommended in the dose of a fluidounce every four hours.

The *Alcoholic Extract* (EXTRACTUM HELLEBORI, *U.S.*), prepared as directed in the U. S. Pharmacopœia, may be administered in the dose of ten or twelve grains.

But the *Tincture of Black Hellebore* (TINCTURA HELLEBORI, *U. S.*, *Lond.*), not unfrequently called *tinctura melampodii*, is the preparation most employed. It is used chiefly in amenorrhœa, in the dose of one or two fluidrachms. Dr. Meade, who especially recommended it in this affection, gave two teaspoonfuls, in a glass of warm water, twice a day.

IV. GAMBOGE.

GAMBOGIA. *U. S.*—CAMBOGIA. *Lond.*, *Ed.*, *Dub.*

Origin. Gamboge is the concrete juice of an unknown tree, growing in the Siamese province of Cambodia, and in Cochin China,

and supposed to be a species of Garcinia, from the close resemblance of its product to that of one of the Garciniæ of Ceylon, the *Hebradendron Cambogioides* of Graham. When the leaves or young shoots of this tree are broken, a yellow opaque juice exudes, which is either received in hollow bamboo canes, where it is allowed to harden, or is collected in convenient receptacles, and, after attaining the proper consistence, is worked by the hand into rolls or other forms. Accordingly, it exists in commerce in two shapes, distinguished as the *pipe*, and the *lump* or *cake gamboge*. The former is in cylindrical rolls, separate or agglutinated together, sometimes bent on themselves, an inch or more in thickness and of variable length, often striated longitudinally on the outer surface, and more or less hollow within. The latter is in irregular masses often filled with impurities, and generally of inferior value. The striated surface of the rolls is ascribed to the impressions from the inner surface of the bamboo, and the hollow in the centre to the shrinking during concretion.

Properties. The colour of the surface is a dull orange, diversified with greenish stains, and often concealed by the yellow powder produced by attrition. The broken surface is conchoidal, smooth, shining, and of a fine reddish-orange colour. The powder is of a beautiful bright yellow. Gamboge is without smell, and has little taste, but, when kept for a short time in the mouth, produces an acrid impression. It is inflammable. With water it forms a beautiful, bright-yellow, opaque emulsion. It is a gum-resin, consisting mainly of gummy and resinous matter, the former of which is soluble in water, the latter in alcohol or ether, and both in alkaline solutions. It is wholly dissolved, when treated successively by water and ether. The colour, acrimony, and medical virtues reside in the resinous ingredient, which constitutes a proportion of the whole, varying, in different specimens, from about 75 to 90 per cent. The resin is quite peculiar, and, having the acid property of neutralizing the alkalies, has received the name of *gambogic acid.*

Medical Properties and Uses. In full doses gamboge is a powerful, drastic, hydragogue cathartic, producing very copious watery stools, and often operating with much harshness. It is very apt to cause nausea and vomiting; and its action is often attended with griping pains and general depression. Its disposition to nauseate shows a special affinity for the upper portion of the alimentary canal, or rather a special susceptibility of this portion of the canal to its influence. Some ascribe this tendency to its ready solubility in the

gastric liquor; but assuredly its active resinous matter is not more readily dissolved than the active matter of aloes, which water takes up, and which acts specially on the opposite extremity of the canal. In smaller doses, it is less disposed to irritate the stomach, while, if sufficiently often repeated, it still operates upon the bowels. The gum-resin is also thought to be diuretic.

In over-doses, it is capable of causing death by the conjoint gastro-intestinal irritation or inflammation, and the great prostration from vomiting and hypercatharsis which it produces. Fatal effects have resulted from a drachm. Dr. Pereira ascribes the deaths which have ensued from the use of enormous quantities of Morrison's pills, mainly to the gamboge contained in them. In these cases, excessive vomiting and purging, pains and tenderness of the abdomen, a weak pulse, and cold extremities have occurred during life, and signs of inflammation, ulceration, and gangrene of the intestines have been noticed after death. (*Mat. Med.*, 3d ed., p. 2027.)

Gamboge may be used whenever an energetic purgative effect is called for, and there is no irritability of the stomach present, and no reason to suspect inflammation of the bowels. But it is much more frequently given with other cathartics, to increase and hasten their action, than alone.

Dropsy is probably the disease in which it is most frequently specially employed. It is adapted to the treatment of this complaint by its powerful hydragogue operation, and its supposed diuretic powers. But caution should be observed in its use, lest it may aggravate any existing intestinal irritation on the one hand, or produce too great prostration on the other. It is peculiarly adapted to cases attended with great torpor of the bowels.

When strong revulsion is required from the head to the bowels, gamboge has been recommended; but its disposition to cause vomiting renders it, I think, of doubtful applicability to these cases.

In worms in the bowels it is often effectual, and has been employed successfully in the expulsion of the tape-worm. The use of it entered into Madame Nouffer's plan of treating the tape-worm, which was purchased by the King of France, and made public by his order.

Administration. The dose of gamboge is from two to six grains. In the treatment of tape-worm from ten to fifteen grains have been recommended. Generally, in order to avoid its nauseating and emetic action, it should be given in small doses of a grain or two

every hour or two until it acts. In the treatment of dropsy, it is most advantageously used in connexion with bitartrate of potassa, of which a drachm may be given with each grain of the gum-resin. The medicine may be administered in pill or emulsion, the latter form being preferable. It has been recommended in dropsical complaints, in the form of *alkaline solution;* and a *tincture* has been used on the Continent of Europe, as a powerful diuretic in these affections, made by digesting, for four days, half an ounce of gamboge and an ounce of carbonate of potassa, previously well rubbed together, in twelve ounces of brandy, and given in the dose of from thirty minims to a fluidrachm. Gamboge is an ingredient of the *compound cathartic pills* of the U. S. Pharmacopœia, which may be properly noticed here, as this is the last of the cathartics I shall have occasion to describe, which enters into their composition.

COMPOUND CATHARTIC PILLS.—PILULÆ CATHARTICÆ COMPOSITÆ. *U. S.*

These pills are made by mixing together compound extract of colocynth, extract of jalap, mild chloride of mercury or calomel, and gamboge, then forming them into a mass with water, and dividing the mass into pills.

They were first introduced into the U. S. Pharmacopœia of 1830; in order that the profession might be in possession of an officinal cathartic compound, uniting all the advantages which had recommended certain empirical or patented pills to general use, and prepared on scientific principles. The special objects aimed at, in their formation, were efficiency and mildness of action, smallness of bulk, and influence upon the hepatic function, in conjunction with their purgative effect. The well established fact, that the more powerful drastic cathartics might, by combination, be deprived of much of their violence or harshness of operation, without any loss of efficiency as cathartics, was taken advantage of in this case. The principle, upon which this result takes place, has been already explained. (See *page* 465.) The cathartic ingredients are colocynth, scammony, and aloes, contained in the compound extract of colocynth, with jalap, gamboge, and calomel added. The several ingredients enter into the composition in the proportion of their mean full doses. It will be perceived that difference in locality and mode of action are secured; the gamboge operating more especially on the upper portion of the alimentary canal, the aloes on the lower, calomel on the liver, and colocynth, scammony, and jalap, about equally on the whole track, though with some difference, in the

character of their action, between colocynth and the other two. It will be noticed, also, that, by the character of the several components, there is secured a hydragogue operation, along with an influence directed more especially to the muscular motion; and a tonic action on the stomach and bowels, so as to balance the tendency to exhaustion from the copious serous discharge. The convenience of smallness of size is obtained by the use of the extracts, in the case of the two most bulky ingredients, namely, colocynth and jalap. Prepared originally upon principle, they have been found to answer well in practice, and are now extensively employed throughout the United States. They may be used in all cases, not complicated with inflammation or irritation of the stomach or bowels, in which brisk purgation is demanded; but are specially applicable to congestion of the portal circulation generally, and either active congestion or torpor of the liver; as in our autumnal fevers at their commencement, bilious disorder with constipation, jaundice, hepatitis, &c.

Each pill contains about 3.5 grains; and three or four pills may be given for a full dose to an adult. One will generally operate as a laxative, and may be given in cases of constipation with deficient biliary secretion. The stools produced by them are generally bilious.

The *London* and *Edinburgh* Colleges have a *Compound Pill of Gamboge* (PILULA CAMBOGIÆ COMPOSITA, *Lond.*), consisting of gamboge, aloes, one or more aromatic ingredients, and soap, which may be given as an active cathartic, in the dose of ten or fifteen grains; but this preparation is not calculated to answer the same purposes as the U. S. pills above described.

V. ELATERIUM. *U. S., Ed., Dub.*

EXTRACTUM ELATERII. *Lond.*

Origin. Elaterium is a substance deposited by the juice of the fruit of *Momordica Elaterium* (*Ecbalium officinarum*, *Ecbalium agreste*, *Ecbalium Elaterium*), the *wild* or *squirting* cucumber, a trailing, herbaceous, perennial plant, bearing considerable resemblance to the common cucumber vine, though without tendrils, growing wild in the South of Europe, and cultivated in England, where the medicine is prepared. The fruit is oval, about an inch and a half long, and like a small cucumber. When quite ripe, it separates from the

stem, and, through the former place of junction, throws out its juice and seeds with great force, and sometimes, according to Mr. Jacob Bell, to a distance of twenty yards. (*Pharm. J. and Trans.*, Oct., 1850.) To procure the elaterium, the fruits are picked before perfect maturity, sliced, and expressed, and the juice thus obtained is set aside for deposition, which takes place in about four hours. The clear liquor is poured off from the deposited matter, which, after being well drained, is spread out upon cloths and dried. This is the ordinary mode of proceeding. The method first employed by Dr. Clutterbuck, which yields the finest product, is to slice the fruits, allow the free juice about the seeds to drain upon a sieve; then to scrape out the interior pulp and seeds, and, having washed these with water upon the sieve, to permit the united liquids to stand until deposition takes place. The deposited matter is then dried. Procured in this way, it is called Clutterbuck's elaterium.

Properties. Good elaterium is in thin, irregular, flat or somewhat curled, wafer-like pieces, often having upon one side the marks of the cloth upon which it was dried, very light, friable, and opaque, of a greenish or grayish-green colour, inodorous, and of a bitter somewhat acrid taste. Inferior kinds are very dark, hard, and of difficult fracture, probably prepared by the evaporation of the juice after deposition; or very light-coloured, friable, and soft, from adulteration, as the drug sold under the name of Maltese elaterium. Both of these should be rejected. Elaterium yields its active matter to alcohol, but not to water.

Active Principle. The purgative properties of elaterium have been found to reside in a peculiar neuter principle, called *elaterin*, which is white, crystallizable, inodorous, of an acrid and extremely bitter taste, insoluble in water, and in alkaline solutions, but dissolved by alcohol, ether, heated olive oil, and the diluted acids. It is most conveniently obtained by treating elaterium with boiling alcohol, which dissolves the elaterin with a green resinous matter, evaporating the tincture until separation begins to take place, and then pouring it into a boiling solution of potassa. The alkaline solution dissolves the green resin, and the elaterin crystallizes on cooling. According to Dr. Morries, English elaterium yields from 15 to 26 per cent. of elaterin; but Mr. Hennel obtained from one specimen as much as 44 per cent. The discovery of the principle was made by these chemists about the same time.

Medical Effects and Uses. The purgative properties of elaterium were known to the ancients. In its local action, it is irritant,

producing severe ophthalmia when brought into contact with the eyes, and causing inflammation and ulceration of the fingers of the persons engaged in its preparation. It is a powerful drastic, hydragogue purgative, prompt in its action, often, in its full dose, producing nausea and vomiting, severe griping pains in the bowels, and much prostration of the general strength; though it produces, at the same time, a stimulant effect upon the circulatory system, as evinced by increased frequency of pulse, dryness of the tongue, and thirst. No cathartic equals it in hydragogue effect, or in general power, and violence of action. In over-doses it produces the effects of an acrid poison, and has repeatedly caused death, with all the symptoms of gastro-intestinal inflammation. This harshness of operation led at one time to its entire abandonment; but its extraordinary powers in dropsy have brought it again into use, and, properly regulated, it may be employed safely, and sometimes with great effect. It is thought also to operate as a diuretic, and thus to be additionally useful in the disease.

It should not be employed indiscriminately in all cases of dropsy, and never when there is any evidence of gastro-intestinal irritation or inflammation. But in obstinate cases, with a tendency to constipation of the bowels, and without febrile complication, which have resisted all other treatment, it should be tried. It has appeared to me best adapted to ascites; and I have seen it promptly successful in that form of the disease, after failure with all other measures. It should be given every second or third day, and may be continued a week or two, if the patient be not too much exhausted, and no evidence of inflammation of the alimentary canal is exhibited. Its stimulant influence on the circulation has a tendency to counteract the depressing effects of the copious evacuation, which might otherwise occasion syncope. Though prudence requires its suspension after the time specified, it may be resumed again subsequently if deemed advisable.

It may be used also in other affections requiring extreme energy of purgative action, but always with caution; and there are few cases, in which all that can be accomplished by cathartics may not be effected by means of others less violent and dangerous.

Administration. The dose of elaterium varies extremely, in consequence of the variable strength of the drug. The purest, prepared according to the method of Clutterbuck, will operate energetically in the dose of one-eighth of a grain, while sometimes two grains of commercial elaterium are required. Unless when the

strength of the drug is known, the practitioner should always begin with small doses, and increase, if necessary, until he has ascertained the amount necessary to act. Perhaps the best plan would be to commence with one-sixth or one-quarter of a grain, repeated every hour or two till it operates, or till found inefficient in that quantity, and then to increase. It may be given in pill or alcoholic solution. The pill is conveniently made with extract of gentian. As elaterin is of uniform strength, and readily prepared, it would be well to substitute it for elaterium; as a definite dose could thus always be obtained. This principle acts in the dose of one-sixteenth or one-twelfth of a grain. One grain of it may be dissolved in a fluidounce of alcohol with four drops of nitric acid, and from thirty to forty minims given for a dose, diluted with water. The acid aids in holding it in solution in water, when the tincture is diluted.

VI. CROTON OIL.

OLEUM TIGLII. *U. S., Lond.*—CROTONIS OLEUM. *Ed.*

Origin. Croton oil is obtained from the seeds of *Croton Tiglium*, a shrub or small tree, growing in different parts of the East Indies. The fruit is a three-celled capsule, with a seed in each cell. The seeds are somewhat larger than a grain of coffee, and consist of an interior oily, light, yellowish-brown kernel, and a thin black shell, covered by a soft yellowish-brown coating, which, being partially rubbed off by friction during carriage, exposes, to a greater or less extent, the black colour of the shell. The kernel is powerfully purgative in the dose of one or two grains; and the seeds themselves have long been employed in Hindostan with a view to this effect. The oil is obtained from them by expression, though it may also be separated by decoction with water, or by the action of ether, which dissolves it, and leaves it behind when evaporated. It is usually brought from India, though prepared also in England by expression.

Properties. Croton oil has an oleaginous consistence, a colour varying from pale yellow to dark reddish-brown, a peculiar odour, and a hot acrid taste, which remains long in the mouth and fauces, with unpleasant effect. There are two varieties of the oil, one pale yellow, and brought from India, the other dark reddish-brown,

and prepared in England. These differ somewhat in their relations to alcohol, the latter being perfectly soluble in an equal volume of that liquid; the former, if shaken with an equal volume, forming an opaque emulsion, which separates upon standing into two parts, the lower consisting of the oil combined with a small portion of the alcohol, the upper of alcohol diminished somewhat in bulk. This difference may possibly be owing to a change which the oil has undergone in the kernel by keeping. (Pereira, *Mat. Med.*, 3d ed., p. 1279.) A portion of oil examined by M. Dublanc, of Paris, when agitated with alcohol, was separated into two parts, one of which, amounting to 6 per cent., was dissolved by the alcohol, the other remained undissolved, but retained 50 per cent. of the alcohol. The latter, by being repeatedly washed with alcohol, lost all its acrid property, while the other portion in alcoholic solution was extremely acrid. From this it may be inferred that the oil consists of two distinct substances, one a bland fixed oil, the other an acrid principle, held in solution by the oil, and probably the active principle as well of the oil as of the seeds. This principle appears to be volatile; for, in certain chemical processes to which the seeds were exposed by Pelletier and Caventou, a vapour was exhaled, under the application of heat, which had a strong nauseous odour and acrid taste, and irritated the eyes and nostrils. It has not, however, been isolated. The crotonic acid, to which the acrid property has been ascribed, has been found by Mr. Redwood to be inert, or nearly so. (*Ibid.*, p. 1274.)

Medical Effects and Uses. Croton oil is a powerful local irritant, producing, when applied to the surface, inflammation attended with a copious eruption, of which I shall have occasion to treat more particularly under the rubefacients. As a purgative, it operates with great rapidity, often in an hour or less. It is also very energetic, though in moderate doses not in general very irritating. In the character of its purgative effect, it must rank with the drastic and hydragogue cathartics; as it produces copious watery stools, and in over-doses occasions nausea, vomiting, hypercatharsis, and severe abdominal pains. Death has been produced by two drachms and a half of the oil, swallowed by mistake. In this case there was no vomiting, but excessive purging, burning pains in the œsophagus, abdominal tenderness, and great prostration, with appearances resembling those of the collapse of cholera. The patient was ill at the time of taking the oil, and was probably purged

to death. No lesion was observed in the stomach. (*Journ. de Chim. Méd.*, 2*e sér.*, v. 509.) There can be little doubt, I think, that the medicine produces its purgative effect by its direct irritant action on the mucous membrane. It is said sometimes to purge, when rubbed upon the anterior surface of the abdomen; but I have never witnessed this effect from the external application of the oil.

The energy and rapidity, and we may add, the comparative mildness with which it operates in ordinary doses, render croton oil a most valuable remedy in certain cases of *obstinate constipation*, and *obstruction from accumulation in the bowels*, which have resisted other cathartics. Every practitioner must have witnessed its good effects, in some of these cases. But care must be taken not to confound such cases with constipation resulting from inflammation of the peritoneal coat of the bowels, or of their whole thickness.

In *apoplexy*, *hemiplegia*, and *coma* from other causes, in which the patient cannot swallow without great difficulty, the smallness of the dose renders the oil of great service; as a drop of it, placed on the back part of the tongue, and repeated if necessary, will often fulfil the indications of energetic purgation and derivation to the bowels, offered by the case.

In *maniacal* cases, and sometimes also in *children*, this smallness of the bulk answers an excellent purpose; enabling us readily to administer the oil without a knowledge of the patient, when there may be a determined resistance to all medicines.

In *dropsical* cases, in which purgation may be indicated, croton oil is among the hydragogues to which we can have recourse; though too energetic for ordinary use.

It has been employed in certain instances of *neuralgia*, and other *nervous disorder*, with so much success, as to have led to the supposition that it might possess a specific influence over the nervous system; but there is no necessity for seeking any other cause of the favourable result than the powerful revulsion from the seat of the disease to the alimentary canal.

The oil has also been recommended in *obstinate amenorrhœa*, and against the *tape-worm*.

I have found it sometimes useful, added in extremely small proportion to aloes and rhubarb, when they have begun to lose their effects on repetition. From one-twelfth to a quarter of a drop, incorporated, in the form of pill, with the ordinary laxative dose of one of these medicines, gives it sufficient activity, with very little additional irritative tendency.

Administration. The dose of croton oil is somewhat indefinite, in consequence of the different susceptibility to its operation in different individuals. There seems to be the same difference in this respect, whether the medicine is applied to the stomach or the skin; some having a remarkable insusceptibility to its action in either way. The oil, however, will generally operate in the dose of from one to three drops. The ordinary method of administration is to make two drops into four pills with the crumb of bread, and give one of these every hour till they operate. It may also be given in emulsion; but the acrid unpleasant impression it leaves in the mouth and fauces is an objection to the liquid form, when these parts have their ordinary sensibility. A tincture may be prepared by dissolving the oil in alcohol, at least so much of it as may be soluble in that liquid. An opportunity is thus afforded for a minute division of the dose. A small quantity may be readily concealed in some article of food, as in molasses, milk, cream, &c.

CATHARTIC ENEMATA.

In relation to the general subject of enemata, enough has been said in the first part of this work. (See *vol.* i., *pp.* 68, 69, and 70.) We have here only to consider them in reference to the evacuation of the bowels. Medicines operate upon the same principles, administered in this method, as when taken by the stomach. They produce contraction of the bowels, either by irritating the mucous membrane, stimulating directly the muscular coat, as by distention, or through the medium of absorption, as is asserted of aloes. They are administered with several objects, or to meet several indications.

1. They are given to hasten or facilitate the action of cathartics administered by the mouth. It often happens that these carry down the contents of the upper bowels into the colon, and then seem to lose their power. Under these circumstances, a stimulation applied directly to the rectum, and thence sympathetically propagated to the colon, is attended with the best effects. The bowels are more thoroughly evacuated than they would be by the cáthartic or enema alone.

2. The stomach may be so irritable that it will not retain purgative medicine; or it may be in a condition quite incompatible with the introduction of any irritating substance into it, as in acute

or chronic gastritis; or the bowels may be in a similar state, contraindicating any direct disturbing influence. Under all these circumstances, should it be desirable to evacuate the contents of the bowels, enemata may be employed.

3. In obstinate constipation, whether from want of irritability, or from spasmodic contraction of the bowels, it is often necessary to bring all possible influences to bear upon them, in order to overcome their inactivity or resistance; and enemata are among the measures to which recourse may be had for this purpose.

4. In mechanical obstruction of the bowels from impacted feces, intussesceptio, &c., it is often necessary to bring in the aid of enemata. In case of feculent accumulation, they serve to soften and then break up the impacted mass. Should invagination of the bowel have occurred, they promise even more advantage than purgatives, because they apply the force in the proper direction for thrusting backward the intruding portion of the bowel. When the difficulty is owing to chronic stricture, tumours, &c., they are necessary, in order, by reducing the feculent matter to a semi-liquid state, to enable it to pass through the narrowed aperture. In any case, even when the cause is not obvious, good may be hoped for from them, and nothing is to be apprehended, with due caution on the part of the operator.

6. In habitual constipation, dependent on torpor of the rectum and lower colon, which often occurs in old persons, they are preferable to laxatives by the mouth, as they do not equally interfere with the digestive process.

7. In flatulence, and tympanites, existing mainly in the large intestines, they are very efficient, because operating more immediately upon the seat of the disorder.

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1. **COMMON ENEMA.** — A purgative injection in common use, and of which the materials are at hand in every family, consists of molasses, olive oil or lard, and common salt, of each a tablespoonful, and a pint of warm water. The whole is to be given at one time. The proportions may be varied to suit peculiar circumstances. Thus, the quantity of all, or of any one of the active constituents may be increased or diminished; or any one of them may be replaced by another substance deemed more effectual or appropriate; as the common salt by sulphate of soda, the olive oil or lard by castor oil, &c. Sometimes an injection of soap-suds operates very effectually.

2. **OLEAGINOUS ENEMATA.**—In irritated states of the mucous membrane of the rectum, in which, nevertheless, there may be an indication for an evacuating injection, one of the fixed oils may be used with great propriety. The oil may be suspended in the vehicle by the intervention of mucilage, the yolk of an egg, or other demulcent material. Two or three fluidounces of castor oil, linseed oil, olive oil, or fresh melted butter, may thus be mixed with a pint of flaxseed mucilage; the castor oil being preferred when the strongest impression is desired, the melted butter when the mildest.

3. **SALINE ENEMATA.**—When somewhat greater activity is required, and especially in febrile conditions, the neutral salts are indicated. Of these, sulphate of soda, sulphate of magnesia, or common salt may be used, in the dose of from two to four ounces, dissolved in a pint or more of warm water. The Dublin *cathartic enema* (ENEMA CATHARTICUM, *Dub.*) consists of an ounce of sulphate of magnesia, a fluidounce of olive oil, and a pint of barley water.

4. **ENEMA OF SENNA.**—Rising in the scale of activity, we come to senna, the infusion of which acts with much energy, and is well calculated for cases of obstinate constipation. An ounce of it may be given infused in a pint of boiling water; the liquid being allowed to cool to the proper temperature. The Edinburgh *cathartic enema* (ENEMA CATHARTICUM, *Ed.*) consists of a pint of senna tea, made with half an ounce of the senna, but with the addition of an ounce of olive oil, half an ounce of sulphate of magnesia, and an ounce of sugar.

5. **ENEMATA of JALAP, SCAMMONY, or COLOCYNTH.**—One of these cathartics may be selected, when the milder have failed, and it is highly important that the bowels should be evacuated. A drachm or two of jalap may be given, suspended in mucilage; or about half the quantity of scammony, rubbed up with milk or the yolk of egg and water; or half a drachm of extract of colocynth and an ounce of soft soap dissolved in water, forming the *Enema of Colocynth* (ENEMA COLOCYNTHIDIS, *Lond.*); a pint of the vehicle being used in each case.

6. **ENEMA OF ALOES.**—ENEMA ALOËS. *Lond.*—This is usually employed with one of two views, either to destroy ascarides, or to stimulate the uterus in amenorrhœa. It may be used, also, when the object is to produce a permanent excitement in the rectum, in order to act revulsively, as in cephalic affections, hemor-

rhages, and diseases of the liver and spleen. Aloes is said, when introduced into the rectum, to act in the same manner as when swallowed. It is slow, and there is reason to think, is absorbed. The London College directs two scruples of aloes, fifteen grains of carbonate of potassa, and half an imperial pint (ten fluidounces) of decoction of barley.

7. **TURPENTINE ENEMA.**—ENEMA TEREBINTHINÆ. *Lond.*, *Ed.*, *Dub.*—This is used specially in tympanites, or flatulence of the bowels; and is one of the most effectual remedies in that condition. It also sometimes answers a good purpose in spasm of the bowels, obstinate constipation, amenorrhœa, and thread worms in the rectum. It may be made by rubbing from half a fluidounce to two fluidounces of the oil with the yolk of an egg, or with mucilage of gum arabic, and mixing it with half a pint or a pint of water. The egg is peculiarly efficacious in facilitating an equable diffusion of the oil in the vehicle, which is important in order to prevent too concentrated an action on any one point of the membrane.

8. **ASSAFETIDA ENEMA.**—ENEMA ASSAFŒTIDÆ. *Lond.*—ENEMA FŒTIDUM. *Ed.*, *Dub.*—Like the preceding, this enema is useful in flatulence and tympanites, and especially when occuring in hysterical females. To prepare it, a drachm of assafetida may be rubbed with half a pint of barley water, flaxseed mucilage, or simply water.

9. **MUCILAGINOUS AND AQUEOUS ENEMATA.**—These operate mainly by distention. They are applicable when there is special reason to avoid irritating the rectum; and should be used habitually in preference to more active substances, when they are found to answer the purpose. *Flaxseed tea*, *barley water*, or *infusion of slippery elm*, may be used. When great bulk is wanted, warm water will answer as well. It is not always that these injections will operate. Indeed, in the ordinary quantity of a pint, they are very apt to be retained, and undergo absorption; in which case, there is usually an increased flow of urine. To produce much effect, they must be given freely, so as to distend the bowels, and in some instances reach even the small intestines. Two evils are to be guarded against in their use; one, injury to the bowel by physical over-distention, the other paralysis of the muscular coat from the same cause. The temperature should be slightly above that of the body, so that it may act as a stimulant. The liquid is best introduced by one of the self-injecting syringes; and it should be

prevented from escaping, by a towel twisted around the pipe, and held firmly against the fundament. The cases to which these injections are most applicable, are those in which there is feculent accumulation to remove, spasmodic contraction to relax, and mechanical obstructions to be overcome. Cold water may sometimes be successfully used in obstinate spasms of the bowels, which have resisted other measures. It seems, by the sudden shock on the nervous centres, to surprise the spasm into relaxation. But this requires caution; for, in feeble persons, whose systems might not have the energy to react, dangerous prostration might be induced.

CLASS III.

DIURETICS.

DIURETICS are medicines which promote the secretion of urine. They may be supposed to operate in one of two methods; either by a sympathetic impression extended from the stomach or other surface of application, through the nervous centres, to the kidneys; or by entering the circulation, and stimulating the glands directly, through contact with their secretory structure. There are other modes of increasing the secretion, to which reference will be made directly; but the agents, in these cases, have no peculiar or specific tendency to act on the kidneys; and the effect is ascribable to certain physiological laws, brought into operation by influences, which, under other circumstances, would equally operate on other functions. Each of the methods above mentioned requires a few words of explanation.

1. *Operation by Sympathy.* Before the fact of the general absorption of medicines had been established by the irresistible evidence of experiment, it was a common belief that the diuretics, as well as most other medicines, acted on parts distant from their seat of application, through the principle of sympathy; in other words, by communication through the nervous centres. A diuretic, admitted into the stomach, made a certain impression upon the mucous coat, which was transmitted to the sympathetic or spinal centres, whence an influence was sent to the kidneys, exciting them to an increased performance of their function. At present it would be difficult to point out a single diuretic medicine, of which it could be reasonably said that it even probably acts in this way; and the only influences, so far as I am aware, that are capable of such an operation through the nerves, are cold applied to any part of the body, and mental emotion acting upon the cerebral centres. Of these more will be said immediately.

2. *Operation through Absorption.* The method in which all the proper diuretic medicines act upon the kidneys is probably by direct contact. In relation to many substances which belong to the class, it has been determined by experiment, that they are

absorbed into the circulation, and escape from it through the kidneys. One great office of these glands appears to be, to depurate the blood of those foreign bodies which find their way into it, and which might otherwise do injury to the system. Hence, the susceptibilities of these organs have been made such, that they feel the presence in the blood of these noxious agents, and are stimulated by them into excessive action in order that they may be thrown off. But, in separating the substances referred to from the circulating mass, the kidneys are compelled to eliminate with them a large proportion of the liquid in which they are dissolved. Thus, most medicines of an acrid or stimulant character, which enter the circulation, and many others which can scarcely be said to have this character, more or less increase the secretion of urine; but it is only to a few of them that the distinctive title of the class is attached; as but a few exercise the property to such an extent, and so uniformly, as to be capable of beneficial employment as mere diuretics.

Allusion was made above to certain influences, not properly medicinal, which have the effect of increasing the function of the kidneys. The operation of diuretics cannot be fully understood, without attention to these influences. They may be arranged under the heads of *cold*, *vascular fulness*, *arterial stimulation*, and *mental emotion*.

1. *Cold as a Diuretic.*

Every one is familiar with the fact that cold has a tendency to increase the secretion of urine. Whether applied to the stomach, the rectum, or the surface of the body, the effect is the same. More urine is passed in winter than summer. The drinking of a glass of ice-cold water, walking bare-foot over a cold floor, or exposure of the body to the cold air, will often in a short time be followed by a flow of urine. This effect is no doubt in part owing to the checking of the sensible or insensible perspiration, possibly also of the pulmonary exhalation, and that of the gastro-intestinal mucous membrane, in consequence of which, the blood, and the matters ordinarily eliminated by these methods, accumulate in the blood-vessels, and of course operate with increased energy on the kidneys, as the only outlet for their escape. But I believe also that such a relation has been established, in our original constitution, through the medium of the nervous centres, between the kidneys and an impression of cold anywhere upon the body, that, when the lat-

ter is experienced, the former are called into increased action. The intention is obvious. Coldness, below a certain standard, is an abnormal state of system, against which nature must provide. To prevent injury from its sedative influence, some counter-agency must be brought into operation. Of this nature is the disposition to reaction, of which I have already sufficiently treated. But there is also another. The perspiration and pulmonary exhalation, through the vaporization of the liquid eliminated from the blood-vessels of the skin and bronchial membrane, are a never ceasing cause of reduction of temperature. But as this is not now wanted, cold has a tendency to check it; and thus one mode of obviating the effects of cold, and restoring the reduced temperature to the proper mean, is put into operation. But the accumulation of liquid in the circulation, consequent on the suspension of these two functions, might do harm, unless some obviating influence existed. This is provided for by those sympathies which determine that cold should directly increase the urinary secretion. Such is the rationale of the operation of cold in augmenting the secretion of urine.

We may often very happily avail ourselves therapeutically of this influence, in aiding the operation of diuretics. Thus, when medicines of this class are exhibited, the patient should take cold drinks, should expose himself moderately to the cold air, and should generally be encouraged to sit up or walk about, rather than lie warmly covered in bed. But care must also be taken not to abuse the influence. If the cold be too strongly, or too steadily applied; independently of its depressing effects, there may be danger of a morbid accumulation internally of blood and nervous power; and high vascular irritation or inflammation of some internal organ, perhaps of the kidneys themselves, may be induced, which, instead of increasing, may diminish or suspend their function.

2. *Vascular Fulness as Diuretic.*

Excess of liquid in the blood-vessels is an abnormal condition, which seeks relief either through the skin or kidneys. If one outlet is closed, the other must in some degree supply its place. Therefore, fulness of the blood-vessels acts as a diuretic, whenever circumstances interfere with the diaphoretic function. Cold has been already stated to have this effect, and to operate as a diuretic even without special fulness of the circulation. But its effect is much increased when this latter condition exists. The drinking largely of cool liquids produces the condition by the rapid absorption of the water. Hence, cool drinks are often powerfully diuretic. The same effect,

to some extent, is produced by the injection of water into the bowels. Immersion in a bath often also disposes to diuresis, while the body is still immersed, and afterwards, if its temperature has not been such as to produce diaphoresis upon exit from it.

It was formerly thought that drinks should be curtailed as far as possible, in the treatment of dropsy, under the apprehension that they might increase the effusion. But any effect of this kind is at present believed to be far overbalanced by their influence in favouring the action of the kidneys, especially when taken cold, and accompanied with diuretics.

It has been supposed that some medicines act as diuretics by *promoting the absorption of effused fluid*, and thus distending the blood-vessels. But it is clear that they have, in consequence of this property alone, no special influence on the kidneys; for it depends altogether on circumstances, whether the effect of this fulness shall be directed to the skin, the kidneys, or, perhaps we might say, the bowels. Should they, however, combine a real affinity for the kidneys, with the property of promoting absorption, they might act with peculiar energy; and this may possibly be one cause of the extraordinary efficiency of digitalis.

It does not necessarily follow that fulness of the blood-vessels should increase the secretion of urine, even when favoured by an unperspiring state of the surface. If the blood is rich as well as abundant, it becomes too stimulant to the kidneys, and may excite an irritation beyond the point of secretion.

3. *Arterial Stimulation as Diuretic.*

The more rapidly the blood is carried through a secreting structure, the greater of course is the amount which comes, within a given time, in contact with that surface, and the more copious must be the secretion. Whatever stimulates the circulatory system, should circumstances prevent a free action of the skin, and especially should they favour a tendency to the kidneys, will produce diuresis. Heat does not, because it favours perspiration. Neither does active exercise, as a general rule: because, though it accelerates the action of the heart, it also has a disposition specially to affect the skin. But stimulation, with coldness, and especially with vascular fulness, greatly promotes the function. Every wine drinker knows the effects of indulgence in that beverage at table. So is it with the other forms of alcoholic drinks, especially the spirituous liquors, and beyond all others gin, which contains a special diuretic ingredient in the oil of juniper. The ethereal liquids have the same

effect; and I have often known even the salts of morphia, notwithstanding their ordinary effect in diminishing the secretions, to act as an energetic diuretic. It is not, however, the pure arterial stimulation in these cases that operates; for the stimulant substance itself, on entering the blood-vessels, often excites the kidneys directly, as well as the heart.

This, like the two preceding influences, may, if carried too far, produce an excitement in the kidneys beyond the point at which they are disposed to secrete, thus obeying one of the universal laws of irritation.

4. *Mental Emotion as Diuretic.*

The passions and emotions have considerable influence over the renal function. Those of a depressing, yet somewhat agitating nature, are peculiarly disposed to act upon the kidneys. Among these is anxiety, or that mixture of fear and hope which anticipates or awaits some important, but doubtful event. The surgeon before he operates, the orator before a great speech, and the young soldier anticipating a battle, afford examples of this kind. Cowardly fear is notorious in its effects; tending not only to increase the secretion, but also, by relaxation of the sphincter of the bladder, to weaken the power of retention. The influence of the hysterical state, and that of the chill of febrile diseases, is probably something of the same nature, operating similarly through the nervous centres.

There is a certain opposition of function between the kidneys and skin, which, in reference to its influence upon the operation of diuretics, is of some importance in a therapeutic point of view. When one of these functions acts in excess, the other is diminished proportionably; and whatever represses one has a tendency to promote the other. The causes of this opposition are not obscure. In the *first place*, by an excitation of one function, the blood and nervous energy are diverted from others not in direct sympathy with it; and *secondly*, if one eliminating function be restrained, the circulation is necessarily overloaded, and becomes directly excitant to the other functions, having the same office, which are consequently brought into increased action. There are many substances which will operate as diuretics or diaphoretics, according as a tendency is given of the general current of excitement to one or the other of the secreting organs. By employing measures to direct action to the surface of the body, we give a tendency of the medi-

cine to the perspiratory function; by repressing perspiration by cold or other measures, we send the medicine with the general current of excitement to the kidneys.

A similar opposition of function, though in a less degree, exists between catharsis and diuresis. Many cathartic medicines, especially the saline and vegetable hydragogues, have a tendency, in small doses, insufficient to purge, to act on the kidneys; but, when they produce their cathartic effect, they no longer prove diuretic. This arises partly, no doubt, from the fact that they are carried out of the system with the evacuations they produce; but it also arises from the general principles before stated in relation to the opposition between diaphoretics and diuretics, that a direction of excitement to one function withdraws it from the others, and that, when the liquid parts of the blood and its excrementitious matter are thrown out by one emunctory, the blood is deprived of its ordinary power of exciting the other eliminating organs. Of the effect of excessive purging and sweating in diverting from the kidneys we have an example in epidemic cholera, in the worst cases of which the urine is often nearly or quite suppressed.

From these facts we deduce the therapeutic conclusions, that, when aiming to produce diuresis, we must refrain from measures calculated to produce diaphoresis, or purgation, and, in relation to the perspiratory function especially, will sometimes find advantage in employing means to repress it.

A high state of fever, or a full plethoric state of the circulation, is unfavourable to the action of diuretics, as of other secretory excitants; because the ultimate tissue which performs the function is too highly irritated to act. So is it also in active congestion and inflammation of the kidneys. Under such circumstances, the loss of blood may facilitate the action of diuretics, by diminishing the renal excitation to a point, compatible with the performance of the function. Any other measures which lower the general or local excitement have the same effect. Besides, when the vessels are full, the medicine is less readily absorbed than when they are relatively empty; and, in this way also, depletion and other reducing measures may favour the operation of these medicines. It is supposed that the action of diuretics is often much promoted by the simultaneous use of medicines, having the property of promoting absorption; and hence, in part, the not unfrequent and often useful practice of combining the preparations of mercury and of iodine with the medicines now under consideration.

Therapeutic Indications and Uses of Diuretics.

The obvious effect of diuretics is to diminish the quantity of liquid in the circulation. It is true that the portion of the blood evacuated by them is chiefly the water; but some of the saline matters, and no doubt also more or less of the organic constituents escape; so that these medicines may be considered depletory. The fact is that, when they operate very profusely, they sometimes produce weakness, approaching even to prostration.

Another important effect, consequent upon the diminution of the watery portion of the blood, is the promotion of absorption. It has been fully established by experiment that the blood-vessels, when their contents are materially diminished, take up water with avidity, wherever they can find it, to supply the loss. The physical physiologist would say that, the density of the blood being increased, endosmosis is promoted; and the explanation may be admitted with some qualification. Thirst also results from the diuretic action, with the obvious purpose of securing a supply of liquid for absorption. But it is not taken up solely from the surfaces with external communication. The liquid in the tissues and cavities is also absorbed; and hence the use of this class of medicines in dropsy.

A third effect is to purify the blood of excrementitious or foreign matter, which may be serving as a source of injury.

A fourth is to impart to the urine the power of dissolving a larger quantity of the saline matter eliminated by the kidneys, while it is at the same time rendered less irritant itself by dilution.

A fifth effect, which is produced only by the stimulating diuretics, is to irritate the lining membrane of the pelvis and calices of the kidneys, the urinary passages, and the bladder, and thus not unfrequently either to alter the diseased surface, or to excite the parts when debilitated or paralyzed to greater activity.

In correspondence with the above indications, diuretics prove useful, and are more or less extensively employed in the following complaints.

Dropsy. It is in the treatment of dropsy that diuretics show their best powers; and in this disease there is no other remedy or combination of remedies that equal them in efficiency. The principle upon which they operate is obvious. Dropsy consists in an abnormal accumulation of effused fluid in the cellular tissue or serous cavities. Diuretics have the effect of promoting the absorption of

that fluid, and its rejection by the kidneys. But if this were all they could do, their utmost advantage would be merely to remove the fluid while operating, and prevent its accumulation so long as they continued to operate. In cases of limited duration, in which the pathological condition on which the effusion depended, terminates, from its own essential character, in a certain period, the diuretics may be said to effect a cure; as stimulants which keep a typhus fever patient alive, until the time for the fever to cease spontaneously, may be said to cure that disease. It is probable that this sometimes happens. In many cases, the pathological condition is quite incurable, as often in organic disease of the heart, cirrhosis of the liver, the advanced stages of Bright's disease, &c. Here all that diuretics can do is to keep down the effusion, and thus protract life, and render the patient more comfortable. But there are also cases of dropsy in which diuretics appear of themselves to effect permanent cures; not to remove the effusion only, but to put the system into a state, in which there is no tendency to a return of the effusion. This I have very often seen, and every experienced practitioner must be familiar with the fact. Cases of dropsy come under the notice of the physician, which have been of long duration, which appear to be regularly advancing, and in which there seems to be no tendency to a favourable termination. Diuretics are prescribed. They act efficiently, and the enormous tumefaction disappears like a snowbank in the sun. Nor, when it has disappeared, does it return. The patient remains perfectly well, and continues so for years. The diuretics then have done more than merely remove the effused liquid. They have favourably modified, perhaps quite removed the pathological condition itself. How is this accomplished? This question can be answered only by conjecture. Dropsy often depends on disease of the kidneys. The diuretics act specially on the kidneys, and may prove useful not merely by increasing their secretory activity, but by altering essentially their morbid condition. They may change the nutrition of the organ, and substitute a new and healthy tissue for the old and diseased. Or the kidney may be undergoing fatty degeneration from its enfeebled condition; and the diuretic may check the process by stimulating the organ into healthy action. Or, lastly, it may be inflamed, and the diuretic may cure the inflammation through its depletory and antiphlogistic properties. Not unfrequently the dropsy depends on a highly irritated or inflamed state of the tissue from which the fluid is exhaled, or perhaps on chronic inflamma-

tion of one of the large organs, as the liver or the heart, which may cause them to interfere with the course of the blood. In these cases, also, the diuretics may be supposed to operate by the antiphlogistic properties, which some of them possess in a high degree.

I know no variety of dropsy in which they may not be given. Upon theoretical grounds, their use has been condemned in the dropsy of Bright's disease; but I am quite sure, from a good deal of experience with them in that affection, that, if properly chosen, they are more effectual than any other medicines. It is true that the stimulating diuretics are not adapted to the acute forms of this affection; even squill has seemed to me occasionally to do harm; but from bitartrate of potassa or digitalis I have never seen mischief produced, but repeatedly cures in very unpromising cases.

Febrile and Inflammatory Diseases. The refrigerant diuretics are beneficial in these affections by their sedative and depletory properties; but they are not frequently used, because their operation is in great degree incompatible with that of more efficient antiphlogistic remedies, as cathartics and diaphoretics. When given for the cure of dropsy, they are often useful incidentally, in accompanying febrile and inflammatory disorder; and sometimes, probably, through their eliminating property, in affections connected with impurities in the blood, as *cutaneous eruptions.*

Disease of the Kidneys and Urinary Organs. In acute inflammation of the kidneys, some of the saline diuretics are useful by their refrigerant and depletory effect, and, when the disease is seated in the pelvis of the kidney, by diluting the urine and rendering it less irritant to the inflamed membrane. In the same way, they act beneficially in inflammation of the bladder and urinary passages. The urine, in these complaints, is often loaded to saturation and even beyond it, with the saline ingredients, in consequence of the small proportion of the liquid eliminated. By increasing this, the salts, which might otherwise be deposited, are held in solution, and those dissolved are rendered less irritant by the dilution.

In chronic inflammation of the pelvis of the kidney, with or without ulceration, the parts are frequently unable to resume healthy action, from their relaxed, debilitated, and indolent condition. These cases are often attended with copious mucous discharges, and not unfrequently with the discharge of pus. Some of the stimulating diuretics, which pass out with the urine, and are thus brought into direct contact with the diseased surfaces, sometimes exercise a most happy influence over them.

Administration.

The rules for the administration of diuretics, so far as they are applicable to the class in general, may be deduced from the observations already made. They should generally be attended with the use of drinks, which should always be cold, and may often be advantageously impregnated with mild diuretic medicines, as, for example, with the vegetable acids, cream of tartar, and sweet spirit of nitre. The milder diuretic infusions may often also be used, as those of juniper, parsley, the erigerons, &c., which may act usefully as adjuvants to the more energetic diuretics employed. Sometimes benefit accrues from the gentle stimulant properties of these drinks, particularly the juniper-berry and wild carrot teas, in correcting the depressing effects of the saline diuretics on the digestive organs. In persons of intemperate habits, or requiring from debility the support of alcoholic stimulation, cold gin and water may be drank with advantage. In relation to the quantity of drink, the patient's own sensations are perhaps in general the best guide; though the advice should be given to take small draughts frequently, in preference to large quantities at once. Should the quantity of urine discharged equal the amount of drink taken, there can be no accumulation; as much is always discharged by cutaneous and pulmonary exhalation.

The diuretic should not, as a general rule, be given at the same time with cathartics or diaphoretics; and the patient should be kept cool, or at least should not be allowed to become heated, as by too much bed covering at night, during their administration.

When the system is in a high state of excitation, with a plethoric condition, and a full strong pulse, it will generally be proper to reduce it somewhat, by depletion or antimonials, before beginning with the diuretics. They will be more apt to operate after this preliminary treatment, than if administered in the highest state of excitement.

As the diuretics are notoriously uncertain, failing often without apparent cause, and often also succeeding when success was hardly expected, it is necessary not to be too soon discouraged; but, after giving a sufficient trial of one, to have recourse to another, or to conjoin two or more together, and, in reference to the more energetic articles, to return to them again and again. I have used certain diuretics long and freely with no apparent advantage, and, having abandoned them, have returned to them, and obtained the most satisfactory

results, though no change was made in their mode of exhibition, and, so far as could be seen, no change had taken place in the patient which could account for the difference.

I. DIGITALIS. *U.S., Lond., Ed., Dub.*

Digitalis has already been treated of generally with the nervous sedatives (ii. 106). It is here to be considered only as a diuretic. In this capacity, it is certainly one of the most efficient medicines known.

Mode of Operation. In the cautious mode in which it is usually deemed safest to administer digitalis, in order to avoid its dangerous depressing effects, and guard against its cumulative tendency, it is slow in its diuretic operation. Several days almost always elapse before any effect is experienced; generally it is not until after a week or two, that its full influence is felt; and sometimes, even when, in the end, it may act energetically, the result is postponed much longer. No doubt, its influence on the kidneys might be sooner obtained by a more energetic administration; but the advantage gained would not be equivalent to the danger incurred. When it does begin to operate, the effect is often sudden and striking. I have visited patients upon one day, passing not more than a pint of urine in twenty-four hours, and, upon the next visit, have found them passing a gallon or more in the same time. The effect, too, after it has begun, continues in general without abatement for several days, even though the medicine should be withheld; and it is a good rule to diminish the dose somewhat, upon the occurrence of profuse diuresis, for fear of too great an accumulation. Should the effect diminish, the original dose must be resumed.

The opinion has been advocated, that digitalis operates as a diuretic, not by a direct action on the kidneys, but by promoting absorption; and the opinion is supported upon the ground, that it does not produce an increased secretion of urine, unless there may be dropsical effusion. But the fact is, that digitalis will sometimes prove diuretic in health; and, if less copiously so than in dropsy, it is probably because there is less liquid in the blood to be eliminated, than when the deficiency produced by the secretory act, can be instantly replaced by the liquid from the tissues and cavities.

Another opinion is, that both the absorption and diuresis are connected with the depressed state of the circulation; the feebleness of the movement of the blood being supposed to favour the endosmose

of liquid from the cavities into the circulation, and its presence there to be the exciting cause of the increased action of the kidneys. But here, again, hypothesis is opposed by fact; for digitalis will often operate as a diuretic, without any appreciable effect on the pulse. Besides, against all the views which refuse to the medicine a direct action of the kidneys is the insurmountable objection that, supposing the dropsical effusion to be absorbed, if the kidneys remain in the same torpid condition, either the liquid taken up will escape again as it did originally, or find its way out of the system, by some other emunctory, as that of the skin, lungs, or bowels.

It is impossible to account for all the effects of digitalis, without admitting a direct influence on the kidneys. This may very possibly be aided by its absorbent influence consequent on the depression of the circulation, but certainly does not exclusively depend upon it.

Therapeutic Application. As a diuretic, digitalis is given only in dropsy; and there is no variety of this disease, strictly speaking, in which it may not be used with a prospect of advantage; for ovarian dropsy and infantile meningitis, in which it is admitted that the medicine is of little or no service, though they are frequently designated as dropsies, are not entitled to the name; at least they are pathologically distinct from the other forms of the disease. Even in dropsies attended with the lowest grade of general strength, there is no positive contraindication to the medicine; for its depressing effects, when cautiously managed, may be readily counteracted by the conjoint use of supporting measures.

But certainly we cannot say of the remedy, what Dr. Withering is stated by Dr. Chapman, in his *Therapeutics* (2nd ed. i. 284), to have declared of it, that "so far as the removal of the water will contribute to cure the patients, so much may be expected from this medicine." On the contrary, the medicine not unfrequently fails entirely to act on the kidneys; and I have seen patients prostrated, under its depressing influence, to the lowest point compatible with safety, in whom, nevertheless, no diuretic effect was produced.

Attempts have been made to indicate the circumstances under which digitalis will be most likely to act efficiently. My own experience coincides with that of Dr. Blackall, who found it most successful in cases attended with coagulable urine; at least I can say truly that no remedy in my hands has seemed equally efficacious, in the dropsies with this condition of the urine, unless possibly bitartrate of potassa. I have witnessed several cases of what appeared to be

decided and obstinate attacks of Bright's disease, with universal dropsy, and unconnected with scarlatina, which yielded completely and permanently to the use of digitalis; and I am convinced that, in some of the cases, it exercises a positively curative influence on the kidneys, independently of the mere increase of their secretion.

Another condition of dropsy to which it is especially applicable, is that which complicates cardiac affections, of a character calling at the same time for the sedative action of the remedy on the heart.

Administration. The commencing dose of the powdered leaves as a diuretic is a grain, which may be repeated three times a day, and increased every other day by one-quarter, or one-half, until its effects begin to be felt, either upon the kidneys, heart, or nervous system. For the dose and method of using the other officinal preparations, I would refer the reader to the article on digitalis among the nervous sedatives (ii. 123). In relation to the infusion, which has been thought by some to be the most effectual diuretic preparation of the medicine, I would simply say, that any superiority of effect obtained from it may be ascribed to the much larger proportional dose in which it is usually given, than either the powder or the tincture. All the preparations are efficient, if well made, and out of good material. I usually prefer the powder prepared immediately from the green portion of the leaves, without the midrib or footstalk.

Great advantage often accrues from giving other medicines with digitalis, either to meet some coincident indication, or to aid in producing its diuretic effects. Thus, in anemic states of the system, it may be combined with iron, in the plethoric or febrile with bitartrate or nitrate of potassa, and in pectoral and hepatic dropsies, often with calomel.

It has been used *externally*, with asserted success, in promoting diuresis, especially in cases of abdominal dropsy. This method may be resorted to when digitalis is not well borne on the stomach, or when it fails to act in the ordinary method. For this purpose, the tincture may be applied by friction to the inside of the thighs and arms, or a strong decoction may be placed, in the form of a cataplasm, or by means of linen cloths saturated with it, over the abdomen. The endermic method is inapplicable, as the digitalis is too irritant in its local operation.

II. SQUILL.

SCILLA. *U. S., Lond., Ed., Dub.*

Origin. Squill is the bulb of *Scilla maritima*, an herbaceous perennial plant, sending up numerous leaves from its bulbous root, in the midst of which an erect flower-stem rises, two or three feet high, and terminating in a spike of closely set, white flowers. The plant is a native of the countries of Europe and Africa bordering on the Mediterranean. The bulb is as large as the fist, or larger, pear-shaped, and composed of numerous fleshy scales, all fixed to a common base, to the lower surface of which the radicals or root fibres, which descend into the earth, are attached. The scales are compactly arranged around a common centre, one overlapping another; the innermost being very juicy, the outermost dry and membranaceous. Sometimes the recent bulb is imported, though rarely. It will keep for a long time if embedded in dry sand, or otherwise excluded from air and moisture. But the common squill of the shops is prepared from the bulb by removing the outer membranous coatings, then cutting it into several transverse slices, and carefully drying the pieces into which the slices separate. In drying, the bulb is said to lose about four-fifths of its weight. There are two varieties of the bulb, one white, and the other of a deep reddish-brown colour externally; but there is no essential difference between them.

Properties. As commonly kept, squill is in small oblong pieces, thin, flexible when moist, but brittle when quite dry, somewhat translucent, usually of a yellowish-white colour, sometimes of a reddish tinge, with a feeble odour, and a bitter, acrid, nauseous taste. It yields its virtues to water, alcohol, or dilute acetic acid. Vinegar is considered an excellent solvent.

In consequence of its affinity for water, squill, unless kept in a dry place, is apt to attract moisture from the air, and thus to become mouldy, and undergo chemical change. From this and other causes, its strength is more or less uncertain, as it is usually found in the shops.

Active Principles. As squill is injured by boiling and by time, its virtues were formerly supposed to be connected with a volatile principle. This seems to have been an error; for water distilled from squill has little or no effect on the animal system. From the most recent investigations by M. Tilloy, as well as from preceding observations,

it appears that there are two distinct active principles; one an *acrid substance*, which is powerfully irritant, may even produce fatal effects, and deteriorates at a high temperature and by time; the other *extremely bitter*, but not acrid, and supposed by Landerer, who obtained it crystallized, to have alkaline properties. It is to the latter that the name of *scillitin* belongs. But the subject needs further investigation. Neither of these principles is obtained separate for use.

Effects on the System. Squill is locally acrid; in the recent state very much so, inflaming, and even blistering the skin when applied to it; but the acrimony is much diminished by drying, and continues to diminish by time. It remains, in greater or less degree, so long as squill is capable of exercising its remedial influence. This acrid property it carries with it into the stomach, into the circulation when absorbed, and into the emunctories through which it escapes from the system. In small doses, without producing any sensible effect on the stomach, squill or its active matter is absorbed, and operates as an excitant to the secretory function of the kidneys and bronchial mucous membrane. It is, therefore, a diuretic and expectorant. In the latter capacity it will be considered hereafter. It is only in reference to the diuretic effect that it is to be considered in this place. There can be little doubt that it operates on the kidneys in its efforts to escape from the system; and when taken very largely, it has been known to bring on inflammation of the urinary passages, with strangury and bloody urine. In doses somewhat larger than is necessary to produce the diuretic effect, it causes nausea, in still larger acts as an emetic, and in excessive doses may occasion inflammation of the stomach and bowels, with vomiting, hypercatharsis, abdominal pains, convulsions, and death. Twenty-four grains of it have produced fatal effects.

Therapeutic Application. Squill was used by the ancients. It ranks among the most energetic diuretics, being inferior only to digitalis and bitartrate of potassa in efficiency. It is much and very advantageously used in dropsy. In consequence of its irritant property, it is not applicable to cases attended with acute inflammation or fever, and is especially contraindicated by the existence of gastro-enteritis, acute nephritis, or inflammation of the urinary passages. It is, therefore, ill adapted to the form of dropsy, attendant on acute Bright's disease. But, with these exceptions, it may be used in any form of the affection, whether anasarcous,

abdominal, thoracic, or even hydrocephalic. My own experience corresponds with that of the late Professor Chapman, who found squill peculiarly useful in hydrothorax. There is, I think, no remedy more efficacious, in either pleural or pericardial dropsy, associated with a state of chronic inflammation or irritation of the membranes, than a combination of squill and calomel. The mercurial is highly efficient in correcting the inflammation, and at the same time seems to aid the squill in its diuretic action, through which the absorption of the effused liquid is effected. The beneficial effect is sometimes very speedy, and, when no serious organic lesion exists, often complete. Even when there is incurable disease of the heart, the liquid is frequently removed, and great relief obtained. When excessive cardiac action complicates the disease, digitalis may be advantageously associated with the other medicines.

Administration. The dose of powdered squill is usually stated at from one to three grains, two or three times a day. As the squill exists in our shops, I have rarely found it, thus administered, to be of any use in dropsy. The individual doses are sufficiently large; but the intervals between them are too long. I now uniformly prescribe squill in dropsy in the dose of two grains *every two hours*, to be continued until it produces its effects. When it is thus given, it will not often be necessary to augment the dose. A long established and a good rule in the exhibition of squill, is, if no effect is produced by the first dose, gradually to increase it until nausea is occasioned, and, having ascertained the point at which it produces this symptom, afterwards so to regulate the dose as to approach the point as nearly as possible, without absolutely reaching it. Some have supposed that the nausea itself is useful in promoting diuresis. Cullen was, I think, right in maintaining that it is no otherwise useful than merely as a sign of the activity of the medicine. I am quite sure that squill is capable of acting very energetically as a diuretic without it. Vomiting and purging are to be avoided, as interfering with the absorption of the medicine, and, if produced, whether by the squill, or the calomel which may be exhibited with it, should be restrained by a little opium. When squill and calomel are used simultaneously, it is, I think, best to give them separately, as each requires to be regulated according to its own effects; the squill being increased or diminished according to its influence on the stomach, the calomel to its action on the mouth. The most convenient method of exhibiting squill is in the form of

pills. There are several officinal preparations, as the *vinegar*, *syrup*, and *tincture*, which, as they are much more used with a view to their expectorant than their diuretic effect, will be more appropriately described under the expectorants, to which the reader is referred. It is sufficient to mention here that the vinegar and tincture may be given in the dose of half a fluidrachm, and the syrup of a fluidrachm, repeated as the dose of the squill in substance. The syrup is frequently used as a diuretic for children, for whom the dose must be diminished according to the regular rule.

There is a large number of vegetable substances more or less used as diuretics, but none of primary importance, which may be conveniently introduced here, in subordination to the two very powerful medicines of the class, above considered. Most of them are used as adjuvants to more efficient remedies in the treatment of dropsy; and some are not without considerable value in this respect.

I. BROOM.—SCOPARIUS. *U. S., Lond.*—SCOPARIUM. *Ed., Dub.*

Origin. Broom, officinally speaking, consists of the tops of *Cytisus Scoparius* (*Spartium Scoparium*, Linn.), or the *common broom plant*, a European shrub, with long, slender, bright green terminal branches, beset with downy ternate leaves, and fine, large, showy, golden yellow flowers, on account of which it is sometimes cultivated in our gardens. These branches, with their leaves and flowers, are the parts employed under the name of tops.

Properties. Fresh broom has a strong characteristic odour when bruised, and a bitter nauseous taste, which it retains after being dried. It imparts all its virtues to water and alcohol. According to Dr. Stenhouse it contains two active principles; one diuretic, which he calls *scoparin*, and the other narcotic, having properties analogous to those of the vegetable volatile alkaloids, for which he proposes the name of *spartein* (*Ann. de Thérap.*, A. D. 1853, p. 153); but these results have not yet, so far as I know, been confirmed.

Medical Effects and Uses. In moderate doses, broom is tonic and diuretic; in larger, emetic and cathartic. Dr. Cullen, in his *Treatise on Materia Medica*, says of it, that, having found it in use among the common people, he had prescribed it to some of his patients, and seldom found it to fail in operating both by stool and urine. Some cases of dropsy were cured by it. Dr. Mead also gives his testimony in its favour; Dr. Pearson considered it tonic and diuretic;

and Dr. Pereira speaks of it in the highest terms of commendation, having found it more certain than any other diuretic. Dr. Christison, however, has had less reason to be satisfied with its effects. (*Dispensatory.*) It is thought not to be well adapted to febrile and inflammatory cases; and, with its tendency to disturb the stomach and bowels, could not be appropriately employed in irritable states of these organs. With these exceptions, it may be used in all kinds of dropsy; and should be tried when others have failed.

Cullen used the medicine in decoction, made with half an ounce of the fresh tops and a pint of water, boiled down to one-half, of which he gave a fluidounce every hour, till it operated on the bowels, or the whole had been taken. The Dublin College directs half an ounce of the dried tops to be boiled for ten minutes in ten fluidounces of water. The dose would be the same. A *compound decoction* is directed by the London and Edinburgh Colleges, made by boiling half an ounce, each, of broom, juniper, and dandelion, in thirty fluidounces of water down to twenty, of which from half a pint to a pint may be taken in divided doses during the day, as an adjuvant to more powerful diuretics.

The *seeds*, which have the same properties, and keep better, may be substituted in the dose of ten or fifteen grains.

II. JUNIPER.—JUNIPERUS. *U. S., Lond.—Juniper Berries.*

Origin. As directed in the U. S. and London Pharmacopœias, juniper consists of the fruit of *Juniperus communis*, or common juniper, a well known evergreen shrub, indigenous in Europe, but introduced into this country, where it grows wild in many places. In addition to the fruit, which is the only part generally used, the Edinburgh and Dublin Colleges direct also the tops, which have similar properties. Though the berries are sometimes collected in this country, they are inferior to those brought from the South of Europe.

Properties and Active Principle. The berries are globular, about as large as a pea, often covered with a glaucous bloom, but of a shining blackish-purple colour when that has been removed, as it often is by rubbing. Their odour is aromatic; their taste sweetish, warm, slightly bitterish, and terebinthinate. Their virtues are extracted by boiling water and alcohol. Besides a considerable proportion of saccharine matter, they contain a peculiar *volatile oil*, upon which their virtues chiefly if not exclusively depend, and which is obtained separate by distillation with water.

Medical Effects and Uses. Juniper is gently stimulant, cordial to the stomach, carminative, and diuretic. The last mentioned effect is produced by the direct action of the volatile oil, which is absorbed, and, escaping somewhat altered through the kidneys, gives to the urine a violet odour. The stimulant operation upon the urinary organs is so considerable, when the medicine is taken freely, as sometimes to occasion symptoms approaching to strangury. Occasionally the diuretic action is very decided, and I have known œdematous effusion to be entirely removed by this medicine unaided; but it is generally used only as an adjuvant to other diuretics. In this capacity, it often answers an excellent purpose in dropsy, especially in connexion with the saline diuretics, the sedative effect of which upon the digestive function it tends to counteract by its stomachic properties, while it furthers their action on the kidneys.

Juniper has been used, with a view to its stimulant operation on the urinary passages, in chronic affections of these parts, connected with mucous or muco-purulent discharge; as *chronic pyelitis*, *catarrh of the bladder*, *gleet*, and *leucorrhœa*. It has also been employed as an alterative in *scorbutic* and *eruptive disorders*, as a gentle stimulant in *debility of the stomach and bowels*, and as an *emmenagogue* in atonic conditions of the uterus. But little reliance can be placed upon it in any of these affections. Almost the only use at present made of it is as an adjuvant to diuretics, and especially as a vehicle for the bitartrate of potassa, for which it is very much and advantageously employed in this country.

Administration. The bruised berries have sometimes been given in substance, rubbed up with sugar, in the dose of a drachm or two, three or four times a day; but the common form of administration is that of infusion. An ounce of the bruised fruit should be macerated in a pint of boiling water, and the whole given in wine-glassful doses during the twenty-four hours. The berries are an ingredient of the *compound decoction of broom* of the London Pharmacopœia. (See *Broom.*) The tops, or soft terminal branches of the shrub, have similar properties with the fruit, though less agreeable. They may be used in the same way.

Oil of Juniper (OLEUM JUNIPERI, *U. S.*, *Lond.*, *Ed.*, *Dub.*) is officinal, and considerably used. It is lighter than water, colourless or yellowish, with a terebinthinate or balsamic odour and taste, and of difficult solubility in alcohol. In the dose of from five to fifteen drops, three times a day, which may be increased if necessary, it

may be used as an adjuvant and corrective of other diuretics, especially digitalis, nitre, and cream of tartar, when not forbidden by any excess of general excitement, or by local irritation in the alimentary canal or urinary organs.

The *Compound Spirit of Juniper* (SPIRITUS JUNIPERI COMPOSITUS, *U. S.*) is directed by the U. S. and all the British Pharmacopœias. According to the U. S. and London authorities, it is prepared by simply dissolving the oils of juniper, caraway, and fennel in diluted alcohol; by the Edinburgh and Dublin, it is directed to be prepared by distillation from the crude materials containing those oils. It has an agreeable flavour, and may be usefully added to diuretic infusions and mixtures, in cases of dropsy requiring a stimulant impression, whether on the stomach or the system. The dose is from two to four fluidrachms.

III. PARSLEY ROOT.—PETROSELINUM. *U. S.*

Origin. This is the root of *Petroselinum sativum* (Apium Petroselinum, *Linn.*), a biennial, umbelliferous, herbaceous plant, indigenous in the South of Europe, but cultivated everywhere in gardens for culinary purposes.

Properties. The root is long, spindle-shaped, about as thick as the finger, wrinkled transversely, fleshy, externally white, internally white towards the circumference, but yellowish in the centre, of an agreeable odour, and a sweetish, aromatic, peculiar taste, which it loses in great measure by boiling, and also when long kept. It should be used in the recent state.

The seeds, which have similar diuretic properties, but are more aromatic, and keep better, may be used for the same purposes. They have a somewhat terebinthinate odour, and a warm aromatic taste. Both these and the root probably owe their virtues to a peculiar volatile oil, which pervades the whole plant.

Medical Effects and Uses. Parsley has long been used as a popular remedy in various disorders, and among others in dropsy. It possesses diuretic and feeble carminative properties, and is occasionally used, in the form of infusion, as an adjuvant to more energetic medicines of the class. It owes much of the reputation which it possesses in this country to the recommendation of the late Professor Chapman, who, in his *Elements of Therapeutics* (2nd ed., i. 276), speaks of it in the following terms: "I know of no diuretic more valuable in certain cases. In dropsy, it has undoubtedly done good, having within my own knowledge, cured ascites, where tapping had been twice used." He considers it, however, still better adapted to cases

of dysentery, and has found it useful in strangury, and the painful micturition of nephritis. One of its advantages is that it is readily retained by the stomach. The infusion may be made with an ounce of the bruised root to a pint of boiling water, and the whole taken, in divided doses, during the day.

IV. DANDELION.—TARAXACUM. *U. S., Lond., Ed., Dub.*

Origin. This is the root of *Leontodon Taraxacum* (Taraxacum Dens-leonis, *De Cand.*), or *common dandelion*, a small herbaceous plant, growing in almost all parts of the globe, and everywhere well known for its bright yellow flowers, which are the ornament of every grass-plat in early spring. The peculiar shape of its leaf, irregularly incised at the edges, with the divisions pointing backward, has, from its fancied resemblance to that of the tooth of the lion, given origin to its name in several languages; as *leontodon* from the Greek, *dens leonis* in the Latin, *Löwenzahn* in German, and *dent de lion* in French, which has been corrupted into our own name of *dandelion*. All parts of the plant exude, when wounded, an opaque, milky, bitterish liquid, with which its virtues are probably connected; as it is deemed efficacious in proportion to the amount of this juice contained in it. The root, however, which is much the strongest part, is the only one officinally recognized. This should be collected in the latter part of the summer, when it most abounds in the milky juice referred to. Though it retains its virtues when carefully dried, it deteriorates by time, and should, therefore, be collected every year; or, what is better, the officinal preparations should be made from the fresh root annually, at its period of greatest activity.

Properties. Dandelion root, when in perfection, is tapering, several inches long, about as thick as the finger where thickest, generally branching, of a light-brown colour externally, whitish within, inodorous, and of a sweetish, bitterish, and peculiar taste. Water and alcohol extract its virtues. A bitter, somewhat acrid, crystallizable principle called *taraxacin* has been obtained from it; but how far the virtues of the plant depend upon it has not been determined.

Medical Effects and Uses. Dandelion has the reputation of being tonic, diuretic, and laxative, with alterative properties, and a special influence on the liver; but very gentle in all its physiological and therapeutic relations. I am not disposed to deny its possession of any of the powers ascribed to it; but it is so often given in connexion with other more active remedies, and of itself is so deficient in energy, that it is extremely difficult to decide how much of the favourable result, in any case, should be ascribed to it.

Of its moderate tonic influence on the digestive function there is, I believe, no doubt. It is equally certain that it occasionally acts upon the bowels, though not to be relied on as a laxative. Its diuretic property has been doubted; but the vulgar name by which it is known in this country, and the no less expressive ordinary designation of the plant in France, are sufficient evidence of the common belief on this point; and, upon a question so purely one of personal observation, I do not think that the general opinion can be mistaken. The chief reputation, however, of dandelion as a therapeutic agent, depends upon its supposed alterative influence, especially on the liver. To this point, there will be occasion to recur when the remedy is considered among the cholagogues. At present it is to be regarded merely as a diuretic. In this capacity, it is frequently used as an adjuvant of other medicines of the class, and particularly in the treatment of those forms of dropsy which are dependent on, or connected with hepatic disorder, whether functional or organic. These are usually abdominal; and it is probably in ascites, with organic disease of the liver, that dandelion is most employed as a diuretic. It may, however, be used in any ordinary case of dropsy, with a tendency to constipation, and deficiency of bile; and, in connexion with other mild diuretics, in the form of infusion or decoction, as in the London *compound decoction of broom*, it may be given as an ordinary diuretic drink, without reference to special indications. It should not be used when the stomach and bowels are in an irritated state. The most common forms of administration are those of infusion or decoction and extract.

Infusion of Dandelion (INFUSUM TARAXACI, *U.S.*) is made by macerating two ounces of the fresh root, bruised, for two hours in a pint of boiling water. The recently dried root may be substituted in half the quantity. The British Pharmacopœias recommend the *decoction*, which may be prepared by boiling the same quantity of the root in one and a half pints of water to a pint. But the virtues of taraxacum are impaired by heat and exposure; and the former mode of preparation is, I think, preferable. The dose of the infusion or decoction is from two to four fluidounces, twice or three times daily, or more frequently if requisite.

The *Extract of Dandelion* (EXTRACTUM TARAXACI, *U.S.*, *Lond.*, *Ed.*) is the most convenient form for administration, and, if properly prepared, at the proper season, and kept duly excluded from the air in a cool place, is probably the best representative of the fresh root

that we can obtain. It should be prepared from the root in August or September, after it has fully ripened, and before it has become injured by the frost, which converts its bitterness into sweetness. The juice, having been expressed, should be inspissated either in vacuo, or by means of a current of warm dry air, directed over the surface, in shallow vessels. The extract, however, is liable to deterioration by time, and should be prepared annually. The dose is from a scruple to a drachm, twice or three times daily. It is most conveniently administered, mixed with water, flavoured or not as may be desired, in such proportion that the dose may be contained in from half a fluidounce to a fluidounce of the menstruum.

V. FLEABANE.—ERIGERON.

Origin. Of the different Erigerons, the U. S. Pharmacopœia recognizes three; namely, E. PHILADELPHICUM, or *Philadelphia fleabane;* E. HETEROPHYLLUM or various-leaved Fleabane; and E. CANADENSE or Canada Fleabane; the whole herb being employed in each instance; and the several botanical titles of the plants adopted as the officinal designations of the medicines. These are herbaceous plants, annual, biennial, or perennial, and abundant in various parts of the United States.

Properties. Two of the species, *E. Philadelphicum* and *E. heterophyllum*, may be considered identical in their properties, and are used in common. In the neighbourhood of Philadelphia, they have long been known under the erroneous name of *scabious*, which properly belongs to a European genus of plants, quite distinct in their character. The herb should be gathered while in flower. They have a feeble aromatic odour and bitterish taste, and impart their virtues to water. The *E. Canadense* or *Canada fleabane* should also be collected when in flower. It has stronger sensible properties than the preceding species; having a decided aromatic odour, and a bitterish, acrid, somewhat astringent taste. All of them contain volatile oil, which is most abundant, probably, in the Canada fleabane.

Medical Effects and Uses. All the Erigerons when given freely in infusion, and taken cold, possess diuretic properties; and the two species first mentioned above, the *Philadelphia* and *various-leaved fleabanes*, have had much testimony in their favour, as mild remedies and adjuvants, in dropsical and nephritic diseases. The late Professor Wistar, of the University of Pennsylvania, used to employ them in dropsy, and found advantage from their use in hydrothorax complicated with gout. They were a favourite remedy also with the

late Dr. Joseph Parrish in similar affections. Drs. Physick and Wm. P. C. Barton employed them advantageously in dysury, attending nephritic disease. Dr. Eberle says of E. heterophyllum, in his work on Materia Medica and Therapeutics (4th ed., ii. 320), that he has been much in the habit of prescribing it in gravelly and hydropic diseases, has found it seldom to fail in producing "pretty copious diuresis," and has derived such advantages from it as to give him "a very high opinion of its remedial powers." All agree that these herbs lie well upon the stomach, and are sometimes received kindly, when other more efficient diuretics are rejected. They are most conveniently administered in infusion, which may be prepared in the proportion of an ounce to the pint of boiling water, and given to the amount of a pint daily.

In relation to *E. Canadense*, it appears, according to the statements of Dr. De Puy, to unite with its diuretic properties, those also of a tonic and astringent; as he found it useful in dropsy and diarrhœa. The dose is from thirty grains to a drachm of the powder, two to four fluidounces of an infusion prepared as that of the other species, and five to ten grains of an aqueous extract.

Attention has recently been attracted to *a volatile oil* obtained from *E. Canadense*, which is described by Professor Procter in the *American Journal of Pharmacy* (xxvi. 502), where it is stated that it was introduced into use by the "Eclectic Physicians," and had been found beneficial in diarrhœa, and various hemorrhages. In the *Transactions of the College of Physicians of Philadelphia* (N. S., ii. 330) is a communication from Dr. Ellwood Wilson, in which it is stated that the oil of *E. Philadelphicum* had been used by Dr. Bournonville and himself in menorrhagia; and several cases are given, in which it appeared to have had an excellent effect. The amount of oil yielded by E. Philadelphicum is extremely small. The dose in which it was given was five drops every two hours. The reader will remember that the oil of turpentine has similar hemostatic properties.

VI. CARROT SEED.—CAROTA. *U. S., Lond., Dub.*

Origin. It is the fruit of *Daucus Carota*, or the common *wild carrot* of Europe and this country, which is designated by the name at the head of this article. The plant is biennial, herbaceous, and umbelliferous, and botanically identical with the carrot of the gardens, which differs from it only by cultivation. The whole umbels of the plant are usually gathered, and kept with the fruit attached in the shops.

Properties. The fruits, commonly called seeds, of the wild carrot are small, oval, flat on one side and convex on the other, and characterized by having, on their convex surface, four longitudinal ridges to which stiff hairs or bristles are attached. They are very light, brownish, of an agreeable aromatic odour, and a warm, pungent, bitterish taste. These properties, as well as their medical virtues belong to a *volatile oil*, which may be separated by distillation with water. They yield their virtues to boiling water.

The root of the wild carrot is whitish, hard, coriaceous, of a strong aromatic odour, and a disagreeable, acrid taste. Its activity probably depends on a volatile oil, and it may be used for the same purposes as the fruit.

Medical Effects and Uses. The wild carrot is a gentle stimulant and carminative, analogous to the aromatics in its properties, but superadding a peculiar tendency to the kidneys, the secretion of which it promotes. It is used chiefly as an adjuvant to stronger diuretics, particularly the saline, when the stomach is enfeebled; and by its stomachic properties serves to obviate the depressing effects of these medicines. It is applicable under similar circumstances with the juniper berries, and may be substituted for them, in the form of infusion, as a vehicle for the cream of tartar, when more agreeable to the patient, or better received by the stomach. It is also used in chronic nephritic diseases, in which it operates, like the oil of turpentine, by coming into contact with the diseased surfaces through the urine, and stimulating or acting as an alterative upon them. The dose of the seeds, in powder or bruised, is half a drachm or a drachm. But the medicine is more commonly given in infusion, prepared by macerating half an ounce in a pint of boiling water, the whole of which may be taken during the day.

I have briefly described above as many of these secondary diuretics as seem to require particular notice. Many other medicines possess also more or less of the diuretic property, for which they have been occasionally used.

The root of our indigenous *Indian hemp*, or *Apocynum Cannabinum*, has emetic, cathartic, and diuretic properties, which are said to have rendered it useful in dropsy.

Cahinca, the root of *Chiococca racemosa* and other species of the same genus, Brazilian plants, has very similar properties, which a few years since gave it a short-lived reputation in the treatment of dropsy and other diseases; but it is scarcely in use at present.

The *roots, tops of the young shoots*, and the *unripe fruit* of *Asparagus officinalis*, or common *garden asparagus*, have gentle diuretic properties, for which they have sometimes been used with relief, in cases of cardiac disease with effusion.

The reader will find the above medicines more fully described in the U. S. Dispensatory. There are others, described elsewhere in this work, which, uniting diuretic powers with those on account of which they are generally used, may sometimes be employed incidentally as diuretics with advantage. Such are *pipsissewa or chimaphila* (i. 131), *tobacco* (ii. 125), and *colchicum* (ii. 386), for an account of which the reader may consult the several articles under these names.

There are yet two divisions of diuretics undescribed, which, from their peculiarity of character, could not be thrown indiscriminately with the others, and will be most conveniently considered in separate groups. These are the refrigerant and stimulating diuretics.

1. *Refrigerant Diuretics.*

I. BITARTRATE OF POTASSA.

POTASSÆ BITARTRAS. *U. S.*

Syn. Cream of Tartar.

Having been particularly described under the cathartics, this salt requires here no further consideration than in relation to its properties and uses as a diuretic. Judging from my own experience, I should be disposed to place cream of tartar at the very head of this class of medicines. Though there may be cases of dropsy which digitalis will cure, and this medicine will not, and others of which the same observation may be made of squill, yet, on the whole, no one medicine, and I think no combination of medicines, will be found to cure so large a proportion of dropsical cases as the one under consideration.

When given in small and frequently repeated doses, so as not to purge, cream of tartar operates as a diuretic, and often very powerfully so, at the same time producing a refrigerant effect on the system. The salt under these circumstances is absorbed. In general, when the neutral salts of the vegetable acids are taken into the stomach, it is believed that the acid is decomposed, and the base

exists in the blood, and is thrown off by the emunctories, as a carbonate, or a chloride, or in some other form of mineral combination. But, according to Wöhler, this is not always the case with acidulous or super-salts, at least with the bitartrate of potassa; for tartaric acid has been found in the urine some time after its administration, and it is highly probable that it enters the circulation in part as the bitartrate. In this way, we may account for its extraordinary diuretic powers; for were it merely by conversion into a carbonate, chloride, &c. that it operates, one of these salts ought to prove equally effectual.

Cream of tartar may be given in all varieties of dropsy, when not forbidden by the existence of an exhausting diarrhœa. Though theoretically applicable more especially to the febrile and inflammatory forms of the disease, I have found it not less effectual in those of a contrary nature, as, for example, that which so frequently follows miasmatic fever, after the disappearance of the febrile disease. It might be supposed to be contraindicated by debility; but I have used it as often in the feeble as the strong, and with not less success. In cases of debility, however, it must be accompanied with tonics and a nutritious diet, to counteract its depressing effects.

Much depends, for success, upon the manner in which the medicine is administered. If given in rather large doses, at long intervals, it will be apt to purge, and not to act as a diuretic, or but slightly; and it is upon its diuretic, and not its cathartic powers, that the chief dependence must be placed in dropsy. Yet it is a mistake to give the salt sparingly. I have noticed that half an ounce, in the course of the day, is generally insufficient to produce any beneficial effect. Less than an ounce in twenty-four hours will seldom answer; and it will not unfrequently be necessary, before it can be brought to act efficaciously, to give an ounce and a half, or even two ounces, in the same length of time. I have often given the latter quantity for many days successively; but have never exceeded it.

The plan which I usually follow is to direct the whole quantity that is to be taken in twenty-four hours, say from three-quarters of an ounce to two ounces, to be put, with a pint of water, or of strained juniper-berry tea, into a bottle; the mixture to be thoroughly shaken when used; and the whole of this quantity to be taken in the time specified, in small doses frequently repeated. The smaller the dose, and the more frequently it is given, the more effectual it will probably be. Not more than a wineglassful

should be taken at once; and this may be repeated every two hours. The direction thoroughly to shake the bottle is important, as otherwise the patient will be apt to drink only the supernatant liquid; by far the larger portion of the salt remaining undissolved at the bottom. The juniper tea is an excellent adjuvant, not so much for its diuretic action, though this is often considerable, as for its stimulant influence on the stomach, which obviates the depressing effect of the salt. The caution should always be observed, to cause the infusion of juniper to be made separately, and to be strained before the salt is added, as otherwise the undissolved salt and the bruised berries would be mixed together at the bottom of the vessel, and much of the former would probably be thrown away. The young reader must remember that cream of tartar is of very difficult solubility in water. Should the medicine purge more than once or twice in the day, unless purgation is aimed at, it should be restrained by opium, so as to prevent it from being carried out of the system, and thus escaping absorption.

II. NITRATE OF POTASSA.

POTASSÆ NITRAS. *U.S.*

Syn. Nitre.

It is only as a diuretic that nitre is to be considered here, having been treated of in other relations with the arterial sedatives. (ii. 83.)

If taken in small and frequently repeated doses, with the free use of cool drinks, and under circumstances of exposure calculated to give a direction of its action rather to the kidneys than the surface, nitre will often operate powerfully as a diuretic. There is no doubt that it enters the circulation, and produces its effects by direct contact with the kidneys, as it has been detected in the urine, after administration by the stomach. Uniting sedative and refrigerant properties with those of a diuretic, it is admirably adapted to cases of febrile and inflammatory dropsy, though it will also act favourably in other cases; due care being taken to guard against its depressing effects.

The dose is ten or fifteen grains, to be given at such intervals that at least two drachms may be taken in twenty-four hours. Less than this quantity cannot be depended on for efficient diuretic action. It may be given dissolved in pure water, barley water, or some diuretic liquid, as infusion of juniper, fleabane, wild carrot, &c.

or water with sweet spirit of nitre; and should also be accompanied with the free use of one of these, or some analogous drink. The patient, moreover, should be kept cool, or at least not warmly covered in bed.

III. ACETATE OF POTASSA.

POTASSÆ ACETAS. *U. S., Lond., Ed., Dub.*

Syn. Sal Diureticus.

Preparation. Acetate of potassa is prepared by treating carbonate of potassa with acetic acid more or less diluted, and evaporating the solution either to dryness, as directed in the U. S. and London Pharmacopœias, or so that it shall upon cooling concrete into a crystalline mass, as ordered by the Edinburgh and Dublin Colleges. When crystallized, it consists of one equivalent of acetic acid, one of potassa, and two of water. It should be kept in well-stopped bottles.

Properties. It is a white salt, exhibiting a fibrous texture when its solution is evaporated to dryness, but foliated when it crystallizes. It is very soft to the touch, of a pungent, saline, disagreeable taste, very soluble in water and alcohol, and extremely deliquescent. By heat it is decomposed, and carbonate of potassa is left. It is known to be an acetate by exhaling the odour of vinegar, when treated with sulphuric acid, and to be a salt of potassa by giving, with an excess of tartaric acid, a precipitate of bitartrate of potassa. It is decomposed by almost all the acids.

Medical Effects and Uses. Acetate of potassa has been known since the thirteenth century. In small doses, frequently repeated, it operates as a diuretic, especially if taken dissolved in a large proportion of water, and the patient is kept cool. In larger doses it is cathartic.

It has been ascertained to render the urine alkaline; the acetic acid being decomposed in the system, and the salt converted into the carbonate; and it is probably mainly in this new form of combination, that it produces its effects. The juices of various plants contain acetate of potassa, and have similar effects.

This salt has been long employed as a diuretic, and formerly had so much reputation as to have received the name of *sal diureticus*, by which it was generally designated. Very different opinions, however, have been entertained as to the degree in which it possesses the diuretic power; and it is certainly much less esteemed in this respect

now than formerly. The statement of Cullen, that "though trying the exhibition of it in various ways, he could never render its diuretic effects remarkable, or fit to be depended on, when a large discharge of urine was required," probably contributed to the disgrace into which it generally fell. Yet there are some who still have a high opinion of its powers, and I have known it to be preferred even to the bitartrate. Having seldom used it, I am unable to decide between the conflicting opinions; but cannot help thinking that they who have formed an unfavourable estimate of its powers, have used it in doses either too small, or not often enough repeated. I know that many failures with cream of tartar have been owing to that cause; and, in consideration of the old reputation of the acetate, and the success obtained with it by some practitioners of the present time, it is very reasonable to suppose, that a want of similar success on the part of others may have depended on an inefficient method of administration.

Dropsy is the disease in which it has been most used; and it may be given under the same circumstances, in this affection, as the bitartrate and nitrate of potassa.

It has, moreover, been used in several other complaints, in which it probably owes its efficacy mainly to its property of rendering the blood and urine alkaline. Thus, it has been found useful in various *cutaneous eruptions*, in which alkalies are among the most efficient remedies. With the same view, it has been used in *acute rheumatism* by some of the advocates of the alkaline method of treating that disease; and has been recommended in the uric acid lithiasis, in which alkalinity of the urine is always aimed at, in order that the urates may be held in solution, and their deposition prevented.

The *dose* with a view to the diuretic effect, or to alkalize the urine, is from half a drachm to a drachm, to be repeated three or four times a day, or more frequently; and it is probable that once every two or three hours would not be too frequent. The medicine should be given in solution. Two or three drachms of it are said to be aperient.

CARBONATE AND BICARBONATE OF POTASSA have also been used as diuretics, and are not without considerable efficiency in this respect. They cannot, however, be depended on exclusively in the treatment of dropsy, but may be used in all cases in which there is a coincident indication for an antacid, either on account of

an excess of acid in the primæ viæ, or the deposition of uric acid or the urates from the urine. The ashes of certain plants formerly had some reputation as diuretics, which they owed to the carbonate of potassa contained in them; and the *sal absinthii* or *salt of wormwood*, which was formerly highly esteemed, was nothing more than an impure carbonate of potassa obtained by lixiviating the ashes of that plant.

CARBONATE AND BICARBONATE OF SODA have, in some degree, the same disposition to excite the kidneys, but are less efficient than the corresponding salts of potassa. *Castile soap*, of which soda is the basis, has also been supposed to possess diuretic properties.

Of all these alkaline carbonates, as well as of *caustic potassa*, which also is diuretic in solution, more will be said when the class of antacids shall come under consideration.

IV. SPIRIT OF NITRIC ETHER.

SPIRITUS ÆTHERIS NITRICI. *U. S., Lond., Ed.*—SPIRITUS ÆTHEREUS NITROSUS. *Dub.*

Syn. Sweet Spirit of Nitre. Spiritus Nitri Dulcis.

Preparation. This is an alcoholic solution of *hyponitrous ether*, formerly called *nitric ether*. Hyponitrous ether is a compound of hyponitrous acid and ether. It is produced by the reaction between nitric acid and alcohol, aided by heat. When these two substances are mixed, nitric acid gives up two of its five equivalents of oxygen, and is converted into hyponitrous acid; the two eqs. of oxygen given up by the acid combine with two eqs. of the hydrogen of a portion of the alcohol, forming water, and changing the alcohol into *aldehyd;* and the hyponitrous acid produced reacts with the remainder of the alcohol, converting it into ether by separating from it an equivalent of water, and then uniting with the ether formed, to produce *hyponitrite of ether*, or *hyponitrous ether*, which is separated from the less volatile ingredients by distillation. To prepare *spirit of nitric ether*, the hyponitrous ether, after its preparation, may be diluted with alcohol; or, what is preferable, alcohol may be used in the original process in more than saturating proportion, so that it may be distilled over with the hyponitrous ether. In the U.S. process, the nitric acid, instead of being added already prepared to the alcohol, is separated, during the process, from

nitrate of potassa by means of sulphuric acid. The product of the first distillation is purified by redistillation from carbonate of potassa, which retains any excess of acid present. The preparation is apt to be contaminated with aldehyd, in consequence of the distillation being carried too far.

Properties. Spirit of nitric ether is a colourless liquid, of a fragrant odour, and a pungent, sweetish, acidulous, and peculiar taste. Prepared according to the U. S. process, it has the sp. gr. 0.834, unites with water and alcohol in all proportions, is very volatile, boils at 160°, and is highly inflammable. When pure, it does not produce effervescence with carbonate of soda, though it reddens vegetable blues, and has a somewhat acidulous taste. It is apt to become sour by keeping, and exposure to the air. This tendency is much increased by the presence of aldehyd, which is converted into acetic acid by combination with the atmospheric oxygen. The presence of this impurity is known by the increased pungency which it gives to the odour, its acrid taste, and by the yellowish colour it produces when a dilute solution of potassa is added. It is injurious, not only chemically, but also by its irritant properties. The preparation is also very liable to be fraudulently diluted with alcohol, the presence of an excess of which it is very difficult to discover, on account of the near approximation of its sp. gr. to that of the spirit of nitric ether.

Medical Effects and Uses. Sweet spirit of nitre appears to have been known so early as the fifteenth century, if not previously. In its effects on the system, it is a nervous stimulant, with the property of increasing the secretion of urine or perspiration, according as it may be directed to the kidneys or the skin. In its local action, it is somewhat excitant to the stomach, and, therefore, operates as a carminative. If allowed to evaporate on the surface, it occasions a sensation of coldness; and it probably produces a similar effect in the stomach upon its first administration, whence its reputation as a refrigerant may have originated.

In over-doses, it would probably operate, like ether and alcohol, as a narcotic poison. In Christison's treatise on poisons, the case of a young woman is related, in whom death was produced by breathing the vapours proceeding from a large quantity of the spirit of nitric ether, which had been accidentally spilled in her apartment. She was found dead in her bed, with the appearance as if she had died in a calm sleep.

Under the diaphoretics, its general remedial effects will be considered. In this place it is treated of as a diuretic. When given

somewhat freely, with a large proportion of cold water, the patient being at the same time kept cool, it acts often with considerable energy as a diuretic; though its influence in this way is too uncertain to be exclusively relied on. It is, therefore, much more used as an adjuvant to other more powerful diuretics than by itself, at least in serious cases of disease.

In reference to its action on the kidneys, it is frequently given, in connexion with other diuretic medicines, as cream of tartar, nitre, squill, and digitalis, in the different forms of *dropsy*; being specially indicated in cases where nervous disorder exists or is apprehended, and in order to obviate the depressing effects of these medicines on the digestive organs.

In *suppression of urine*, when not dependent on nephritis, it often answers an admirable purpose. This condition not unfrequently attends febrile diseases, and occurs in children without assignable cause, unless, it may be, some disturbance in the nervous functions. In such cases, sweet spirit of nitre is habitually resorted to, and often with complete success. When there is uric acid deposition in the urine, it may be usefully combined, in many instances, with the alkaline carbonates or bicarbonates. In *strangury* it is frequently useful by diluting the urine, and is much employed in that affection resulting from blisters.

It is peculiarly adapted, in consequence of its properties as a nervous stimulant, to the above affections occurring in young children, whose nervous systems are extremely prone to derangement in most of their diseases. It should not be given during the existence of acute and extensive inflammation.

The dose as a diuretic is a fluidrachm, given in a glass of cold water, and repeated every two, three, or four hours; or, when no great effect is desired, two or three times a day. A good plan is to put this or double the quantity in a tumbler of ice-cold water, and allow the patient to sip it at short intervals, through the day and night, when he may desire drink. The dose may be increased to two, three, or even four fluidrachms. For a child two years old, from ten to fifteen minims (twenty to thirty drops) may be given at a dose.

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2. *Stimulating Diuretics.*

These are characterized by an excitant influence over the general circulation, but more especially by passing out with the urine, and

stimulating the whole track of the urinary passages. They are employed much less for their diuretic powers, which are in general feeble or uncertain, than for their excitant and alterative action directly on the mucous membrane lining these passages, and sympathetically on the parts in their immediate neighbourhood.

I. TURPENTINE.

TEREBINTHINA.

The word turpentine, in its general acceptation, is used to signify an oleo-resinous juice, obtained from different trees belonging to the family of pines, and has been extended so as to embrace juices, of analogous character, from other plants, without very accurate discrimination. The reader will find a notice of these products in the U. S. Dispensatory. Only two of them are officinally recognized in this country, and to these I propose to confine myself. The others have medical properties essentially the same, and may be used for the same purposes.

1. TURPENTINE.—*Terebinthina.* U.S., Lond., Dub.—*White Turpentine.—Common American Turpentine.*

The product thus designated is the juice chiefly of *Pinus palustris*, or the *long-leaved pine* of our Southern Atlantic States, from which it is obtained by making excavations into the trunk of the tree. From these the turpentine is removed as it collects, and is transferred to casks, where it concretes. Portions of it are said also to be procured from *Pinus Tada*, the *loblolly* or *old field pine* of Virginia and North Carolina. Vast quantities of it are collected in North Carolina; and attention has recently been turned to this source of wealth also in Georgia, Florida, and Alabama. As in the shops, it is in concrete, irregular, yellowish-white masses, of various consistence, sometimes, especially when recent, and in warm weather, so soft as to be almost diffluent, in other instances hard, brittle, and translucent, and of all intervening grades.

2. CANADA TURPENTINE.—*Terebinthina Canadensis.* U.S.—*Balsamum Canadense.* Ed.—*Canada Balsam.—Balsam of Fir.*

This is obtained from *Abies balsamea*, the *American silver fir*, or *balm of Gilead tree*, a beautiful evergreen, growing abundantly in our northernmost States and in the British Provinces, and cultivated as an ornament in gardens, and pleasure grounds. The juice collects in small receptacles immediately beneath the bark, forming blisters

on the surface, from which it is gathered by cutting into them, and receiving it as it flows out in bottles. It is of a thick, liquid consistence, resembling that of honey, beautifully transparent, colourless or yellowish, and very tenacious. By time and exposure it becomes thicker, and ultimately solid.

General Properties of the Turpentines. The turpentines may be liquid, solid, or of any intermediate degree of consistence, according to the length of exposure, and the temperature at the time; being more solid in proportion to their age, and harder in cold than hot weather. They have a peculiar not disagreeable odour, and a warm, pungent, bitterish, and peculiar taste; and the term *terebinthinate* is applied to these properties, when met with of analogous character in other substances. The smell and taste vary somewhat in the different varieties; but is characteristic in all. The turpentines, if solid, soften with heat, and become adhesive. At a higher heat they melt, and at a still higher take fire, and burn with a bright flame but much smoke. They yield scarcely anything to water; but are wholly dissolved by alcohol, ether, and the liquid oils: and with the fats unite thoroughly by fusion. They consist essentially of resinous matter and volatile oil, which are in somewhat different proportions in the different kinds. The proportion of the oil in our common turpentine, when recent, is stated at 17 per cent., in the Canada turpentine at 18.6 per cent. But it varies much in the same variety in different states. The solidification of the terebinthinate juices by time and exposure, is owing partly to the escape of the volatile oil, partly to its oxidation and conversion into resin. The oil is obtained separate by distillation, and is called *oil of turpentine.* It is to this that the turpentines owe their effects on the system. The remaining resinous matter is designated in our Pharmacopœia as *resin* or *resina*, and is much used for preparing ointments, cerates, and plasters. The liquid turpentines may be consolidated by mixing them with a small proportion of magnesia, which forms a solid chemical compound with the resin, and absorbs the oil.

Effects on the System. The effects of turpentine on the system are essentially the same with those of the volatile oil, being, however, produced somewhat more slowly, and in somewhat less degree. They have similar local irritant properties, though much milder, and in like manner stimulate the circulation, excite the kidneys, impart odour to the urine, irritate not unfrequently the urinary passages, and operate everywhere as alteratives upon the tissues

which they penetrate. They sometimes also act as laxatives; but the same quick purgative effect, and secondary influence on the brain are not obtained from them as from large doses of the oil; because it is almost impossible to administer them in equivalent quantities, and, even were they taken thus abundantly into the stomach, the oil is so involved with the resin that it could not exercise its full powers. Whenever the turpentines act on the system, otherwise than as local irritants or excitants, it is through the absorption of their oil.

Turpentine is at present seldom used internally; but is occasionally preferred to the oil, when a slow effect, with little general stimulation, is required. The classes of disease in which it may be given, are, 1. *chronic inflammation or debility of the urinary and genital apparatus*, 2. *chronic bronchial inflammation*, 3. *ulcerative affections of the bowels*, such as *chronic diarrhœa* and *dysentery*; and 4. *chronic rheumatic affections*, especially *sciatica* and *lumbago*. It has also been given in *piles*. It is unnecessary to particularize each disease; as this will be done directly, in treating of the volatile oil in reference to its influence on the urinary organs, or has been done already, when the same medicine was considered as an arterial stimulant.

The dose of turpentine is from twenty grains to a drachm, three or four times a day. It may be given in pill, electuary, or emulsion. The pill is preferable when extreme slowness of action is desired, or it is wished to direct the medicine to the lower bowels especially. The electuary may be made by incorporating it with syrup or molasses, or, if in the liquid state, by rubbing it with powdered liquorice root. On the whole, emulsion is the best form. It may be prepared by rubbing the turpentine first with the yolk of egg and sugar, and then with water. If gum arabic and sugar are used as the intermedium, it would be well to bring the turpentine first into a liquid state, by means of olive or almond oil, then to mix the solution with the gum previously formed into mucilage, and finally to incorporate them with the water. Half an ounce or an ounce, suspended by these means in water, constitutes a good enema in cases of flatulence, and of thread-worm, especially when the oil itself is too irritating.

The following substances may be considered in connexion with turpentine, as they are derived from it directly or indirectly.

1. **OIL OF TURPENTINE.**—OLEUM TEREBINTHINÆ. *U. S., Lond., Ed., Dub.*

Effects on the Urinary Passages. The oil is to be considered here only in its relations to the urinary organs. When taken in small doses, frequently repeated, it soon shows its tendency, after having been absorbed, to escape from the system through the kidneys, and to stimulate these organs in its passage. This is first evinced by an odour imparted to the urine, thought to resemble that of violets, and quite different from that of the oil itself, which is no doubt somewhat modified before escaping. It is thought, however, that a portion of the oil is also eliminated unchanged by the same outlet. The quantity of urine is also generally more or less increased; and the disposition to evacuate it, even in greater proportion. If the medicine is persevered with, the urine becomes more irritant, and a sense of unpleasant warmth is felt in its passage. This sometimes increases to a burning pain; a smarting or cutting sensation is experienced in the urethra at each discharge; the disposition to micturition becomes very frequent, a minute quantity only being passed at once, and this sometimes high-coloured or bloody; and the patient suffers under fully formed strangury. With this, there is not unfrequently pain in the small of the back, and along the course of the ureters. Instead of diuresis, the secretion is now diminished, in consequence of the excess of irritation of the urinary organs. The excitement sometimes passes also to the rectum producing tenesmus, and to the genitals. To the extent, however, here described, the irritant influence of the oil is not often carried; as the effect is usually slowly induced, and the medicine is omitted with the occurrence of the milder symptoms. There is, moreover, a great difference of susceptibility to the effect; and many patients take the oil for a long time without any inconvenience of the kind. Others are extremely susceptible, and very small quantities induce strangury. Sometimes it produces decided hemorrhage from the kidneys; and I have seen a case of this kind caused by inhalation of the vapours from turpentine. The patient was a seaman, who had just come from a voyage on board of a vessel loaded with this product. The treatment of strangury will be given under cantharides.

Therapeutic Application. The conditions in which the oil of turpentine is used with reference to its effects on the urinary organs, are either functional debility of these organs, or neighbour-

ing parts which are influenced through contiguous sympathy, or chronic inflammation of the same parts.

It is not often that the oil is used in dropsy; and, in febrile or inflammatory cases of the disease, and especially when the kidneys are in a state of active congestion or inflammation, as in the acute variety of Bright's disease, it is not only useless, but injurious. There are, however, cases of dropsy, in which the urine is scanty in consequence of torpor of the kidneys, without inflammation, and in which the oil may be employed usefully as an adjuvant to other medicines, more decidedly diuretic.

In *suppression of urine*, or very scanty secretion from mere functional disorder, oil of turpentine will sometimes be useful; but great care must be taken not to mistake, for such a case, a condition of irritation or inflammation of the organ, which is more frequently the source of renal ischuria than torpor or debility.

I have repeatedly derived advantage from the oil in cases of excessive and exhausting *diuresis*, connected apparently with a nervous state of the system, or with a weakened and perhaps flaccid state of the organ, allowing the watery parts of the blood to escape, as they do from the skin in the night sweats of debility.

Chronic inflammation of the pelvis of the kidney, in which there is reason to suspect ulceration, as indicated by pus or blood in the urine, traceable to a renal origin, is sometimes much benefited by the oil, which is peculiarly efficacious in promoting a healing tendency in indolent ulcers, with which it is brought duly in contact, whether on the surface of the body, in the alimentary canal, or the urinary passages. Even without reason to suspect ulceration, when there is copious mucous or muco-purulent discharge, and the case is destitute of acute symptoms, the oil will often prove useful.

In obstinate cases of *gravel or lithiasis*, the oil occasionally appears to act very happily, bringing away large quantities of sandy matter, with great relief to the patient. It is possible that, in these cases, the gravelly matters may have been lodged in the uriniferous tubules, and may be discharged through the stimulant influence of the oil, either acting directly on the tubules, or by means of the liquid secretion which it promotes, and which may wash down the accumulated and irritating material.

In *similar affections of the bladder*, that is ulceration, or chronic mucous or muco-purulent discharge, oil of turpentine may prove

serviceable, when not too stimulant for the case. It is among the standard remedies in chronic cystirrhœa.

In *gleet* too, or chronic mucous or puruloid discharges from the urethra, it may be used with some hope of good; but this complaint is generally much more effectively treated by local remedies. The same may be said of *leucorrhœa*, though, as this discharge proceeds usually from a source beyond the reach of the oil passing with the urine, no great benefit can be expected.

The extension of an excitant influence from the mucous to the muscular coat, renders the oil of turpentine useful in certain cases of *retention of urine*, dependent on debility or palsy of the bladder, and of *incontinence* arising from a similar condition of the sphincter. It is one of the remedies which may be tried in *nocturnal incontinence*.

In *hemorrhages* from the *urinary passages* or the *uterus*, when purely passive, or sustained by habit, oil of turpentine is one of the best hæmostatics that can be used; having a peculiar power of suppressing hemorrhage wherever it may occur.

In *debilitated conditions of the genital apparatus*, whether male or female, and in *similar conditions of the rectum*, the oil may be tried, upon the ground that, even though it may have no general tendency to the pelvic viscera and closely connected parts, it may at least stimulate them through an excitant influence, radiating from the urinary organs. Hence it may be used in *impotence, sterility*, certain conditions of *spermatorrhœa, amenorrhœa* from torpor of the uterus, *relaxed piles, rectal discharges*, &c., either alone, or variously combined.

The dose of the oil for all these purposes is from ten to thirty drops, twice or three times a day, or more frequently, taken either in emulsion, or simply dropped on sugar.

2. TAR. — PIX LIQUIDA. *U. S., Lond., Ed., Dub.*

Preparation. Tar is procured by the slow combustion of pine wood, so covered with earth as to admit but a scanty supply of atmospheric air. The heat caused by the burning of a portion of the wood serves to char the remainder; and the resinous ingredient, melted and partially changed, mixes with the condensed products arising from the decomposition of the wood, and flows out in a semiliquid form; charcoal being left behind. Almost all the tar of the U. States is prepared in N. Carolina, and other pine regions of the South.

Properties. This is a semiliquid, very tenacious substance, nearly black, of a peculiar, empyreumatic, not disagreeable odour, and

a bitterish, resinous, acidulous taste. It is highly inflammable. Water dissolves a small portion of its constituents. It is soluble in alcohol, ether, and the fixed and volatile oils.

Composition. Tar is a very complex substance, containing resin, acetic acid, oil of turpentine, water, and various volatile products of the decomposition of ligneous and resinous matter, condensed in the liquid form. When distilled, it yields two products; one consisting mainly of acetic acid with water and various impurities, called *pyroligneous* acid; the other an oily liquid called the *empyreumatic oil of tar.* This oil is extremely complex, yielding to analysis no less than seven distinct substances, of which two only, *picamar* and *creasote*, have any particular interest for the physician; the former as the bitter principle of tar, the latter as an important remedial agent. I have always, however, doubted whether creasote exists in a free state in tar; for this has none whatever of its distinctive odour, unless treated with an alkali, when the smell of creasote is strongly developed. Any one may convince himself of this by applying tar to his hands, and then washing them with soap and water. I infer that creasote is either neutralized in tar by combination, or that in fact it is a product of reaction among the constituents of tar; and we are not, therefore, to expect the same physiological and remedial effects from the two substances.

Medical Properties and Uses. Tar is very analogous in its effects to the turpentines. It is locally irritant, and, admitted into the system, proves stimulant to the circulation, and to the secretory functions, especially that of the kidneys. Along with its diuretic operation, it sometimes irritates the urinary passages, producing pain and other symptoms of strangury. It is also probably excitant to the bronchial mucous membrane, and, like turpentine, exercises a stimulant influence over the ultimate tissues everywhere. That a portion of its active matter is absorbed, is evinced by its odour in the urine and other excretions, when largely swallowed. In large quantities, it is capable of exciting high vascular irritation or inflammation in the stomach and bowels.

Though possessed of most valuable properties as a local stimulant, tar is seldom used internally. It may, however, be employed, either in substance or infusion, in the various *affections of the urinary organs* to which turpentine is adapted; and has been used, to a considerable extent, in *chronic bronchial* inflammation, with a view to its stimulant and alterative influence on the mucous membrane. It has also been used in *obstinate piles*, and is thought by some to exercise a very favourable influence over certain *ulcerative or chronic*

inflammatory conditions of the intestinal mucous membrane. When we come to the consideration of the rubefacients, it will be seen that tar acts almost like a specific in certain cutaneous eruptions. A close analogy has been supposed to exist between certain obstinate diseases of the bowels, and these affections of the skin; and it has not unreasonably been supposed that tar might produce, in the former, effects analogous to those which it so obviously produces in the latter. Hence, it has been used by Drs. Simpson and Cumming, of Edinburgh, and with supposed benefit, in an obstinate variety of pseudomembranous inflammation of the bowels, with which the inhabitants of that town are afflicted, and of which I have met with examples in this country. (See my *Treatise on the Practice of Medicine*, 4th ed., i. 590.) It may, indeed, be given, with reasonable hope of benefit, in obstinate chronic inflammation of the intestines generally, whether enteritic or dysenteric, and with or without ulceration or false membrane; provided all symptoms of acuteness are absent.

The *vapour of tar* is often highly useful in chronic bronchial inflammation, or other pectoral disease attended with copious mucous, or muco-purulent expectoration. I have seen it do much apparent good in these cases; but it should be long and steadily persevered with. It probably acts as a mild stimulant and alterative to the diseased membrane, and the surface of cavities. I have no idea, however, that it can materially modify tuberculous disease of the lungs. For the method of using the vapour, the reader is referred to the general observations on inhalations (i. 77).

Administration. The dose of tar in substance is from half a drachm to a drachm; and from two drachms to half an ounce may be taken daily. It may be given either in the form of pill, made with some absorbent substance, as wheat flour, or powdered liquorice root, or in electuary made by mixing it with sugar.

Tar Water (AQUA PICIS LIQUIDÆ) has been a good deal used in pectoral and urinary disorders, and as a wash in cutaneous eruptions; more, however, formerly than at present; though I have no doubt that it is occasionally efficacious, especially in diseases of the urinary passages. It is made by stirring together a pint of tar and half a gallon of water, and straining after the subsidence of the tar. It has a reddish-brown colour, somewhat of the odour of tar, and an acidulous, sharp, empyreumatic taste, which it owes to the acetic acid, and the oil of tar held in solution by means of the acid. One or two pints of it may be used daily.

For a preparation of tar called *beer* or *wine of tar*, see *U. S. Dispensatory.*

3. **CREASOTE.**—CREASOTUM. *U. S., Lond., Ed., Dub.*

Preparation. Creasote is one of the products of the destructive distillation of wood. It exists, therefore, in smoke, which owes its preservative property to this ingredient, and it enters into the constitution of tar. It probably results from the decomposition of resinous matter. I have before stated my belief that, if ready formed in tar, it must exist so combined as to neutralize its most extraordinary properties. It is procured by distilling tar, treating the empyreumatic oil thus obtained with carbonate of potassa, decanting an oily liquid which separates, and submitting this to a complex process, in order to purify the creasote. (See *U. S. Dispensatory.*)

Properties. When pure, creasote is a colourless liquid, of an oily appearance and feel, leaving a greasy stain upon paper, which, however, is not permanent. As found in the shops, it is often brownish from impurity. It has a very peculiar, strong, diffusive, permanent, disagreeable, empyreumatic odour, and a hot, unpleasant, acrid, almost corrosive taste. It is somewhat heavier than water, volatilizes on exposure, boils at 397°, burns with flame, and is soluble in alcohol, ether, the volatile and fixed oils, naphtha, acetic acid, and alkaline solutions. It dissolves iodine, phosphorus, sulphur, and the resins. With water it forms two combinations; one containing 1 part of creasote in 80 of water, the other 1 part of water in 10 of creasote. It is a neuter substance, and consists of carbon, hydrogen, and oxygen. When quite pure, it may be kept long without change.

Effects on the System. Two important properties possessed by creasote, which may be mentioned here, as they are the source of much of its usefulness as a medicine, are, *first*, its extraordinary power of preventing and correcting animal decomposition, and *secondly*, its property of coagulating albumen. In its physiological operation, it is a powerful local irritant, and, applied undiluted to the skin, produces heat and redness, and corrugates and corrodes the cuticle, which separates in furfuraceous scales. Applied in the same way to the mucous membranes, it whitens them, causes a separation of the epithelium, and inflames the tissue beneath. In reference, however, to these local properties, and to the therapeutic applications based upon them, it will be considered with the rubefacients. At present, it is only as an internal remedy that it will occupy our attention.

When swallowed in moderate doses, as of one or two drops, it produces at first no other obvious phenomena than a sense of heat in the throat and stomach; but, if its use be continued, it frequently increases the secretion of urine, which sometimes becomes of a dark colour, and has the odour of the medicine. The breath also has the same smell. By a longer continuance, symptoms of strangury may come on, resembling those produced by the oil of turpentine, which creasote resembles closely in its operation on the urinary organs, though less energetic. If the dose is larger, gastro-intestinal irritation is produced, with nausea, vomiting, and abdominal pains, and occasionally, when the quantity taken has been very large, symptoms of diarrhœa or dysentery. In excessive doses, it becomes poisonous; and with the symptoms of gastro-intestinal irritation there are now mingled signs of cerebral disturbance, as giddiness, headache, dimness or disturbance of vision, and even insensibility, or convulsions. Death from two drachms of it is said to have occurred (Pereira, *Mat. Med.*, 3d ed., p. 2014); but I have seen no details of a fatal case. The treatment would be to empty the stomach and bowels, and then allay irritation by opiates, and support the system if necessary; inflammation, should it occur, being combated by the usual remedies.

That creasote enters the circulation, is proved by its smell in the breath and the urine. Its effects upon the kidneys are no doubt the result of its direct contact with their secreting structure. The cerebral phenomena may proceed from its direct action on the brain, or may be secondary to the gastro-intestinal affection. In small doses, it shows no narcotic powers. The effects on the stomach and bowels are probably the pure result of local irritation.

Therapeutic Application. Creasote may be used in all the urinary affections for which the oil of turpentine is administered, though probably less efficient. It has been strongly recommended in *diabetes;* but experience has not confirmed the first favourable anticipations. It may sometimes have palliated the gastric symptoms, and diminished the urinary discharge; but it has produced no material influence on the disease. I gave it a very full trial in one case, without benefit. In *copious diuresis*, however, proceeding from debility or nervous disorder, it may be expected, like the oil of turpentine, to produce good by stimulating the renal tissue.

The most beneficial therapeutic influence of creasote, internally administered, is probably the relief of *nausea* and *vomiting.* It is

certainly very effectual in cases of this kind, of a purely functional or nervous character, as the vomiting of hysteria and pregnancy, and that sympathetic of Bright's disease of the kidneys; and it is asserted to be useful also in *sea-sickness*, though, in this affection, I have little confidence in its powers; but it scarcely merits all the commendation it has received as an anti-emetic, for it not unfrequently fails in the cases apparently most favourable for its influence, and is incomparably inferior to opiates. To cases of vascular irritation, or acute inflammation of the stomach, it is altogether inappropriate. I believe that its action as an anti-emetic depends on no peculiar sedative or anodyne influence, as some have supposed, but simply on the stimulant effect it undoubtedly has upon the organ, and which very much resembles that of the aromatic oils, which are also admirable anti-emetics.

In cases of *chronic gastritis* with vomiting, especially when there is reason to suspect ulceration, it would probably occasionally prove useful by its stimulant action upon the ulcerated surface, exactly as it operates favourably upon similar ulcers of the skin.

Upon the same principle, I am prepared to admit that it may be useful, like oil of turpentine, in *intestinal ulceration*, and consequently may have produced good results in obstinate cases of diarrhœa, and even chronic dysentery, in the former of which it has been strongly recommended.

That it will occasionally relieve *gastrodynia* and *cardialgic uneasiness*, is very probable; but so will any other stimulant or carminative volatile oil, and oil of turpentine often acts energetically in this way. But it is by no special anodyne power that creasote acts in these cases.

Creasote has also been used with a view to its stimulant or alterative influence over the bronchial mucous membrane, in *chronic or pituitous catarrh*, *asthma*, and *phthisis*; and here also the same advantages may be expected from it as from the terebinthinate remedies.

It is said to have proved efficient in *neuralgia*, but I have little faith in its power over this disorder; and though, like everything else capable of producing a decided impression upon the system, it may have afforded relief in some cases, experience has proved that it is inadequate to the successful treatment of that complaint, and cannot be relied on even as a palliative.

In *hysteria*, in which also it has been recommended, though it may have afforded relief sometimes as a gastric stimulant, it has no special curative powers.

The *inhalation* of the vapour has been used with advantage in *chronic bronchial diseases*, and is especially applicable when there is an excess of secretion, from a relaxed state of the bronchial mucous membrane.

The reader will have inferred, from what has been said above, that I have no belief in the possession by creasote of any extraordinary or mysterious powers as a general remedy, considering it simply as a local stimulant to any part with which it may come into contact, with a somewhat greater disposition to act on the kidneys than other organs which it reaches through the circulation.

Administration. The dose of creasote, to begin with, is one or two drops, three times a day in chronic cases, every hour or two in the more acute, to be increased gradually if required, and if tolerated by the stomach, up to five or six drops, or more. As much as ninety drops have been given, within twelve hours, without ill effects. The dose of the oil may be most conveniently administered shaken up with a wineglassful of some sweetened aromatic water, or in the same quantity of diluted syrup or mucilage duly flavoured. The Edinburgh College directs a *Creasote Mixture* (MISTURA CREASOTI, *Ed.*), which is made by mixing sixteen minims of creasote with the same quantity of acetic acid, then gradually adding fourteen fluidounces of water, and finally a fluidounce, each, of syrup, and of compound spirit of juniper. The acid aids the solution of the oil. The dose of the mixture, containing a minim of creasote, is one fluidounce.

II. COPAIBA. *U.S., Lond., Ed.*

Syn. Copaiva Balsam. *Dub.*

Origin. Copaiba is the juice of *Copaifera officinalis*, *C. multijuga*, and other species of the same genus, handsome trees, growing in the W. Indies, Brazil, Venezuela, and other parts of South America. It is obtained by making incisions into the stem, from which it flows out copiously, thin, transparent, and colourless. In a short time it becomes more consistent, and acquires a yellowish hue, and in this condition is imported.

Properties and Composition. Copaiba is a clear liquid, of a consistence varying with its age, but usually approaching that of olive oil, a pale yellowish colour, a peculiar not disagreeable odour, and a hot, bitterish, nauseous taste. It is usually somewhat lighter than

water, inflammable, insoluble in water, but readily dissolved by strong alcohol, ether, the fixed and volatile oils, and alkaline solutions. It consists essentially of a peculiar volatile oil, and two resins, one of which, constituting much the larger portion, has acid properties, and forms compounds with salifiable bases.

When magnesia is mixed with copaiba in certain proportions, which vary with the quantity of the volatile oil, the mixture gradually concretes; the earth uniting with the resinous acid, to form a solid insoluble compound, which absorbs the oil. The alkalies, on the contrary, form soluble compounds with the resin of the copaiba, which, when dissolved in water, have the property of holding the volatile oil in solution. Hence the solubility of copaiba in the solutions of the alkalies.

The proportion of the volatile oil varies greatly; being in certain varieties in all probability originally greater than in others, and afterwards diminishing with the age and degree of exposure. Thus, while recent copaiba has yielded 80 per cent. of the oil, older specimens have been found to contain but little more than 30 per cent., and the proportion is indefinitely diminished by time, until the juice becomes concrete. On the average, it may perhaps be stated at about 40 per cent. This result is owing partly to the volatilization of the oil, partly to its oxidation, and conversion into a resin, which appears to be identical with the non-acid resinous constituent of the juice. The volatile oil is the active principle of copaiba.

Effects on the System. Copaiba is locally and generally stimulant, with a tendency to act on the bowels, and to increase the secretions, especially that of the kidneys. It ranks, therefore, with the stimulating diuretics. In its influence on the system, as well as in its chemical nature, it is closely allied to the turpentines.

In moderate doses, it produces a sensation of warmth in the throat and stomach, not unfrequently operates as a laxative, and, after a short time, shows signs of having been absorbed, by imparting its odour to the urine and the breath. The urine is in general sensibly increased in quantity, acquires frequently a darker colour, and sometimes becomes coagulable by nitric acid, in consequence of the elimination of an albuminoid substance. But, according to Dr. G. Owen Rees, this substance differs from ordinary albumen in not subsiding after coagulation. If continued long, or given largely, the copaiba is apt to disturb the bowels, to excite the cir-

culation, and produce an obvious irritation of the urinary passages, evinced by a disposition to frequent micturition, and uneasy sensation of burning or pain in passing urine. Occasionally, also a roseolous or papulous eruption is produced on the skin, with or without itching and tingling. From still larger quantities, or, in irritable constitutions, even from the ordinary remedial doses, a universal irritative effect is produced, with a frequent pulse, hot skin, often headache, furred tongue, anorexia, and sometimes nausea and vomiting, with or without purging and abdominal pains, constituting a complete febrile condition, which subsides in a day or two on the omission of the medicine, and the adoption of an antiphlogistic regimen. The irritation of the urinary organs sometimes amounts to complete strangury, with scalding and cutting pains, bloody and scanty urine, &c. Occasionally the renal irritation is so great that the kidneys almost cease to secrete.

Therapeutic Application. Copaiba has been known as a medicine since about the middle of the seventeenth century, though its greatest popularity dates from a much more recent period. It is chiefly employed for its stimulant and alterative influence on the mucous membranes, upon which it appears to operate by direct contact. Thus, in the stomach and bowels, it is of course in contact with the alimentary mucous membrane; and, after absorption, its volatile oil, escaping by the lungs and kidneys, acts on the bronchial membrane in the former case, and upon that of the urinary passages in the latter, as it passes out with the urine.

In reference to the urinary organs, though it undoubtedly stimulates the kidneys and increases the secretion by its moderate influence, and has sometimes been employed, on this account, in dropsies, its use at present is confined almost exclusively to cases in which the mucous membrane is affected. *Gonorrhœa* is the disease in which copaiba is most employed. In this complaint, it may be given either in the early stage, before the symptoms have become highly inflammatory, or in the latter stages, after the inflammation has subsided. Given freely in the former condition of the disease, it will sometimes put a speedy end to it; but at some hazard of increasing the inflammation, if it should not succeed. It has, indeed, been accused of inducing attacks of swelled testicle; and it is certain that such attacks not unfrequently come on under its use; but they occur also under other circumstances, and it is very difficult to determine what agency, in any particular instance, the medicine may have had in the production of the complaint. When high inflammation

already exists, it appears to me that copaiba is wholly contraindicated; and, though it may not always aggravate the disease, and may even sometimes prove useful, the risk, upon the whole, is much greater than any probable benefit. It is to the advanced stage, then, that the remedy is peculiarly applicable; and here it may be employed without hesitation; due care being taken so to regulate the dose as not to bring on strangury, or throw the stomach and bowels, or the general system into disorder. When the medicine is disposed to run off by the bowels, the tendency may be corrected by a little opium. To be successful, it should be given in the largest quantities compatible with the cautions just inculcated.

Its use has been extended to *gleet*, *leucorrhœa*, and chronic *cystirrhœa*, in all of which it is occasionally serviceable. It may also be employed, like oil of turpentine, in chronic *pyelitis*, especially when there is reason to suspect the existence of *ulceration*.

As a stimulant and alterative to the bronchial mucous membrane, copaiba may sometimes be used with advantage in the *advanced* and *suppurative stage of bronchitis*, and in the chronic conditions of that affection, attended with *copious mucous, or muco-puruloid expectoration*. It is inappropriate to *phthisis;* for, though it might relieve the attendant bronchial disease, it would be likely to do injury by disturbing the digestive organs, which should be maintained in as sound a condition as possible in that complaint.

In *chronic inflammation of the intestinal mucous membrane*, especially when attended with ulcers, or supposed to be so, it would appear to be clearly indicated; and it has, in fact, been employed with decided advantage, associated with opiates, in chronic *diarrhœa and dysentery*. In these affections, it is applicable under the same circumstances as those already pointed out, as requiring the use of oil of turpentine (i. 565). It has been substituted, in *typhoid fever*, for the oil of turpentine, in the treatment of the ulcerative affection of the bowels attendant on the advanced stage of that complaint. *Hemorrhoids* are said also to have been occasionally benefited by the internal use of copaiba.

Locally, the medicine has been applied as a stimulant to chilblains, and indolent ulcers; but is in no respect superior to the terebinthinate substances.

Administration. The dose of copaiba is from twenty minims to a fluidrachm, which may be repeated three times a day. But this dose is more especially applicable to affections of the urinary organs. When the medicine is given in pectoral affections, or those of the

bowels, I prefer small doses more frequently repeated; as ten or fifteen minims every two hours; and, under these circumstances, it generally acts better when associated with small doses of laudanum. The medicine is sometimes taken simply dropped on sugar; but this mode of exhibition is generally too offensive to the taste and stomach to be tolerated. Another method is to administer it suspended in some aromatic water; and, mixed in equal measure with the spirit of nitric ether, it is often conveniently given in this way. On the whole, however, the preferable mode of exhibition is that of *emulsion*, in which the copaiba is rubbed up with the yolk of an egg, or mucilage of gum arabic and loaf sugar, and then mixed with one of the aromatic waters. The proportions should be such, that a tablespoonful of the emulsion may contain a dose of the medicine. This is preferable to the other forms; because the particles of the oleo-resin are thus divided, and consequently rendered less irritating; and, being more diffused through the stomach, would be likely to undergo a more ready absorption.

Another method, adapted to cases in which the taste is very squeamish, but the stomach strong, is that of the gelatin capsules, each one of which may contain ten or twelve drops. (See *U. S. Dispensatory.*)

Pills of Copaiba (PILULÆ COPAIBÆ, *U. S.*) are directed, in our national Pharmacopœia, to be made by incorporating copaiba with one-sixteenth of its weight of magnesia, and setting by the mixture until it concretes sufficiently to be made into pills. Each pill contains about five grains, and from two to six may be given at a dose. It will, however, often be necessary, in their preparation, to use a much larger proportion of magnesia, if the juice is fresh, and abounds in oil. Copaiba may also be made into pills by incorporating the liquid with sufficient absorbent powder, such as liquorice root, to bring it to the proper consistence.

Oil of Copaiba (OLEUM COPAIBÆ, *U. S., Lond., Ed.*) is an eligible preparation, bearing to the copaiba the same relation that oil of turpentine does to the turpentines. It is prepared by a double distillation of the oleo-resin with water. When pure, it is colourless, of the odour and taste of copaiba, soluble in alcohol and ether, and composed exclusively of carbon and hydrogen; being isomeric with pure oil of turpentine. On exposure, however, it absorbs oxygen, and is ultimately converted into resin. It may be taken in large doses with impunity, having no positively poisonous properties, and in this respect also resembling the oil of turpentine.

The dose of it is from eight to thirty minims, which may be taken in any of the different modes above indicated for the copaiba itself.

III. BUCHU. *U. S., Lond., Dub.*

BUCKU. *Ed.*

Origin. Buchu consists of the leaves of several small shrubs of Southern Africa, belonging to the genus *Barosma*, of which *B. crenata*, *B. crenulata*, and *B. serratifolia*, are particularly designated as sources of the medicine. It is collected by the Hottentots of the Cape of Good Hope, who use it not only as a medicine, but as an agreeable scent in their rough toilet, rubbing their greasy bodies with the powder.

Properties. The leaves are an inch or less in length, from three to five lines broad, of various shape, ovate, lanceolate, or obovate, delicately notched at the edges, punctuated on the under surface, of a strong, somewhat aromatic odour, and a warm, bitterish, mint-like taste. They yield their virtues to water and alcohol, though in larger proportion to the latter. These virtues depend chiefly on a volatile oil, and in part probably a bitter principle, which ranks with the extractive matters.

Medical Effects and Uses. The use of buchu, as well as the name, was derived from the Hottentots; and it is but a few years since it came into notice in this country and Europe. It appears to be a local and general stimulant, with some tonic properties, and a disposition to operate specially on the urinary organs. The last mentioned property is owing to the absorption of the volatile oil, and its elimination by the kidneys, so that it exercises its stimulant property upon these organs and the passages by direct contact. It acts as a diuretic, and imparts its odour to the urine; but, if given in warm infusion, while the patient is confined to bed, it seems to receive a direction to the surface, and operates as a diaphoretic.

The complaints in which it is mainly used are debility and chronic inflammation of the pelvis of the kidney, ureters, bladder, and urethra, particularly when attended with excessive discharge of mucous, or a muco-purulent matter. There is nothing special in its action, nothing in which it materially differs, so far as the urinary organs are concerned, from oil of turpentine, except that it is milder. It is, therefore, applicable to the conditions before

mentioned as calling for the use of that oil (see *page* 605), and may be preferably employed whenever an impression is desired less stimulant than that of the terebinthinate remedy, and more so than that of uva ursi or pipsissewa. Its tonic properties also adapt it to cases in which the digestion is enfeebled, while the urinary apparatus is disordered. It has been employed in *dropsy*, in which it may sometimes be useful as an adjuvant, through its mild diuretic property. In rheumatism, moreover, it is supposed to be sometimes useful; and here, too, it resembles the oil of turpentine. Finally, it has been employed in cutaneous affections.

Administration. The dose of the powdered leaves is twenty or thirty grains, two or three times daily. The *Infusion* (INFUSUM BUCHU), which is directed by all the officinal authorities, is much more used. It is made in the proportion of an ounce to the pint of water, and given in the dose of one or two fluidounces. A *Tincture* (TINCTURA BUCHU) is directed by the Dublin and Edinburgh Colleges, of which the dose is from one to four fluidrachms. Though not officinal, a *fluid extract* made like that of valerian, is an eligible preparation, and may be given in the dose of a fluidrachm.

IV. PAREIRA BRAVA.

PAREIRA. *U.S.*, *Lond.*, *Ed.*, *Dub.*

Origin and Properties. Pareira brava is supposed to be the root of *Cissampelos Pareira*, a climbing plant of the West Indies and South America. It is in cylindrical pieces, sometimes branched or contorted, of variable size, from two or three inches to several feet in length, and from half an inch to two or three inches in thickness, and covered with a closely adhering, brownish bark, with longitudinal and transverse wrinkles, and sometimes knotty excrescences. The interior woody portion is yellowish, soft, and marked with concentric circles. The root is without smell, and of a taste which is at first sweetish, but afterwards bitter and nauseous. Its activity probably depends on an alkaline principle, discovered by Wiggers, and denominated *cissampelina*, which has not, however, been isolated for use. The virtues of the root are readily extracted by water and alcohol.

Medical Effects and Uses. This is an old remedy, recently revived, probably to be soon again forgotten. It was used in Europe before the commencement of the last century, and was sup-

posed to possess an extraordinary influence over calculous affections, and various other diseases of the urinary organs. The fact seems to be, that it is a gentle tonic, occasionally acting as a diuretic and aperient, and applicable, therefore, to cases of feeble digestion, with a tendency to costiveness, and offering indications for a tonic impression on the urinary organs. It is mainly on the favourable opinion of Sir B. Brodie that the reputation of the medicine rests. By that eminent surgeon it has been used with advantage in complaints of the urinary passages, attended with mucous or purulent discharges, as gonorrhœa, cystirrhœa, &c. He believes that, while it modifies the character of the discharge, it also lessens the irritability of the organ.

The *dose* of the powder is from thirty grains to a drachm; but the medicine is more frequently given in decoction or infusion.

The *Infusion* (INFUSUM PAREIRÆ, *Ed.*, *Dub.*) is made in the proportion of an ounce to the pint; the *Decoction* (DECOCTUM PAREIRÆ, *Lond.*) by boiling an ounce in a pint and a half of water to a pint. The dose is one or two fluidounces.

An *Aqueous Extract* (EXTRACTUM PAREIRÆ, *Lond.*, *Ed.*) is also officinal, and is given in the dose of ten grains to half a drachm. Some add the extract to the infusion and decoction to increase their strength.

In whatever mode exhibited, the medicine may be advantageously combined, in cases of irritable bladder, with one of the narcotics, as lactucarium, hyoscyamus, or conium.

CANTHARIDES.

CANTHARIS. *U. S.*, *Lond.*, *Ed.*, *Dub.*

Syn. Spanish Flies.

The proper place for considering the subject of cantharides generally, will be among the epispastics. I shall here confine myself to its effects and uses as an internal medicine.

Effects on the System. Cantharides* is a powerful local irritant, and a general stimulant to the circulation, with a peculiar disposition to act on the urinary organs, and the pelvic viscera generally.

* It will be noticed that I use the term cantharides, as having been adopted into the English language as a name for the medicine; and in this capacity, there is an obvious convenience in considering it as in the singular number.

In regard to its topical effects and uses, I shall treat of it with the epispastics. In this place, we are concerned with it only as an internal remedy. In observing the operation of cantharides, we may distinguish two sets of symptoms mingled together; those, namely, which result from its direct action on the alimentary mucous membrane, and those which follow its absorption. The reader will have no difficulty in discriminating between these two categories, in the general picture of its effects which follows.

When given in moderate doses, no obvious impression is produced for some time, unless perhaps a feeling of warmth in the throat and stomach; but, after a few repetitions of the dose, a sense of heat or uneasiness is felt in the urethra, with a disposition to micturate more frequently than in health, some increase in the quantity of urine, and perhaps a slight excitation of the genital organs. With a longer continuance of the medicine, or an increase of the dose, these phenomena become much more prominent. There is now a constant disposition to pass the urine, which, instead of being increased in quantity, is often much diminished, coming away in a few drops at each effort, and often very high coloured, or bloody. Severe burning or cutting pain accompanies the discharge; there is a constant uneasiness in the course of the urinary passages; and not unfrequently violent pains are experienced in the small of the back, in the groin, and down the thighs. The rectum is sometimes involved, and the sufferings of severe tenesmus are added to those of strangury. The irritation, moreover, often extends to the genitals, and painful priapism, with other corresponding phenomena, are induced. Occasionally, too, there is more or less diaphoresis. With these local phenomena, the pulse is rendered more frequent and tense, the skin hot, the breathing hurried, anorexia comes on, more or less nervous disturbance is experienced, and a general febrile condition is established. These phenomena may be rapidly produced by over-doses; but they may all occur from a frequent and continued repetition of the ordinary remedial doses. Beyond these effects, the operation of the medicine may be considered as poisonous.

Poisonous Effects. The phenomena produced by poisonous quantities of cantharides are burning pain in the stomach, nausea and vomiting, thirst, dryness and constriction of the throat with difficult deglutition, sometimes ptyalism, fetid smell of the breath, violent gripings, tenesmus, bloody stools, exquisite tenderness of the abdomen, excruciating pains in the small of the back, loins,

and hypogastric region, incessant disposition to micturate with the discharge of a few drops of blood, intense and durable priapism, violent uterine irritation in women, with occasional abortion in pregnancy, and inflammation more or less extensive of the urinary and genital apparatus, sometimes attended with gangrene. At first there is general excitement of the circulatory system; but, after a time, the system sinks, and faintness, feeble pulse, coldness of the surface, general sweats, giddiness, headache, delirium sometimes furious, convulsions of a tetanic character, and coma ensue. Death takes place, in some cases, from the intensity of the inflammation with the consequent gangrene; in others, apparently from the poisonous action upon the brain. A fatal result, according to Orfila, has taken place from 24 grains of the powdered flies; and very threatening symptoms are known to have ensued from a fluid-ounce of the tincture. Upon dissection, the marks of inflammation, and sometimes of gangrene are to be seen in the mucous membrane of the stomach and bowels, and in that of the urinary and genital organs, and of congestion in the brain.

Treatment of the Poisoning. This consists in the evacuation of the cantharides by emetics and cathartics; with the free use of demulcent drinks; opiates by the mouth and rectum; and measures calculated to obviate inflammation, as bleeding, leeching, emollients, the warm bath, blistering, and the antiphlogistic regimen; care being taken to obviate prostration by a due amount of nutriment.

Mode of Operating. The symptoms of gastric and intestinal irritation or inflammation are probably mainly due to the direct action of the poison as swallowed; those exhibited in the urino-genital apparatus, and the nervous system, upon its influence after absorption. This influence, though universally irritant, is directed especially to the urinary and genital organs, and the whole contents of the pelvis, including the rectum; and a proof of this is that the same effects are often produced by the external application of the flies, though seldom to so serious an extent. It is uncertain whether the nervous symptoms are owing to the direct influence of the absorbed poison upon the nervous centres, or to the reaction upon these of the inflammation in the alimentary canal, and urino-genital apparatus. In favour of the latter opinion is the circumstance, that they generally do not make their appearance until some time after the others, occasionally not until several days subsequent to the introduction of the poison.

There is very great difference of susceptibility, in different individuals, to the influence of cantharides, and especially in relation to its effects on the urinary organs. In some, strangury is always induced by very small doses; in others, large quantities may be taken without the slightest effect of the kind.

Therapeutic Application. Cantharides was employed habitually by the ancient Greek and Roman physicians. As a therapeutic agent, it is now mainly used in reference to its influence on the urinary and genital organs.

In *dropsy*, it is asserted to have been occasionally given with advantage as a diuretic; but its operation in this way is too uncertain to be relied on under any circumstances, and, in many cases, particularly those of a febrile nature, and attended with active congestion or inflammation of the kidneys, it is positively, and very strongly contraindicated. The only circumstances, under which it would be appropriate in dropsy, are when there is great torpor of the kidneys, without the least evidence of vascular excitement in the organ; and even then it should be used cautiously, and only in connexion with more decided diuretics.

Its most beneficial application is to *paralytic* or *very debilitated states of the urino-genital apparatus*, in which it is often useful. It may be employed, in all these cases, when the affection is local and functional; or when, supposing it to have arisen from inflammation in the parts, or from lesions of the nervous centres, there is reason to believe that the original cause has ceased to act, and nothing but the debility or inability remains. The special affections are the same as those already mentioned under oil of turpentine (see *page* 605); namely, *retention* and *incontinence of urine*, the former dependent on paralysis or weakness of the muscular coat of the bladder, the latter on the same condition of the sphincters; *nocturnal incontinence*, in which it is among the most efficient remedies; *paralysis of the sphincter of the rectum* or *of the rectum itself; obstinate gleet* and *leucorrhœa;* long continued *cystirrhœa;* some cases of *spermatorrhœa*, purely the result of debility; *impotence* and *sterility;* and *amenorrhœa.*

It has been used with asserted advantage in *diabetes;* but in the true disease of that name, characterized by saccharine urine, it is wholly useless, if not injurious. In certain cases, however, of simple excessive *diuresis*, it may prove useful, like the oil of turpentine, when the affection is purely functional, and especially when connected with a relaxed or atonic state of the kidneys.

It is supposed, when circulating through the tissues, to be capable of exercising an excitant and alterative influence upon their ultimate structure, so as to prove useful in certain very obstinate local affections, by changing the nature of the diseased action. Hence it has been recommended internally in *old and indolent ulcers*, and especially in *obstinate cutaneous eruptions*. In the latter it appears to have been employed by the ancients, and, in recent times, has been again brought into notice by M. Biett, who has used it with great success. The cases to which it is applicable are the scaly affections, as *psoriasis* and *lepra*, and *eczema* and *impetigo* in their most advanced and scaly stage. But these are the very affections in which arsenic, in small and perfectly safe doses, operates usually with great effect, and without the unpleasant symptoms so apt to result from cantharides; so that the latter is comparatively little used.

The dose of cantharides is from half a grain to two grains, which may be given morning and evening, in the form of pill. The tincture, however, is always preferable, as it does not, like the fly in substance, come undiluted in contact with the coats of the stomach. The dose of it is from fifteen minims to a fluidrachm; the latter quantity containing the strength of nearly two grains of the medicine, when the tincture is prepared according to the U. S. officinal directions. It should be given in a wineglassful of water, or some demulcent liquid.

There are a few other substances, of minor importance, which belong to the stimulant division of the diuretics. Of these, horseradish, mustard, and garlic merit a brief notice.

I. HORSE-RADISH.—ARMORACIA. *U. S., Lond., Ed.*

Horse-radish is the root of *Cochlearia Armoracia*, an herbaceous perennial plant, indigenous in Europe, but everywhere cultivated in gardens for culinary purposes.

The fresh root is long, tapering, often branched, white, fleshy, of a strong, pungent odour when bruised, and a hot, biting, sweetish taste. These properties, as well as its medical virtues, it imparts to water and alcohol. They are dependent on a volatile oil, which may be separated by distillation with water. This oil is extremely fugitive, being dissipated by the drying of the root, and wholly driven off by boiling. It is supposed to be formed by certain reactions, similar to those which take place in mustard, to which the reader is referred, among the rubefacients. It is only in the

recent state that the root is employed in medicine. In this state, it may be kept for a long time, if buried in dry sand, in a cool place.

Medical Effects and Uses. Horse-radish is an active local irritant, having general stimulating properties, with a disposition to increase the secretions, especially that of urine. Taken into the stomach, it stimulates that organ, increasing the appetite, and invigorating digestion; and is much employed as a condiment for this purpose. It also has carminative properties. Its volatile oil is absorbed, and stimulates the circulation, and the emunctories as it escapes through them. In over-doses, it sometimes causes vomiting. In medicine, it is occasionally used as a diuretic in dropsy, attended with a feeble state of the system, impaired digestion, and an atonic condition of the kidneys; but chiefly in connexion with other diuretics. It has also been employed in cases of *palsy* and *chronic rheumatism*, as a preventive and remedy in *scurvy*, as a *masticatory*, and as a remedy in *hoarseness*. For the last mentioned purpose it was used by Dr. Cullen, who gave it in the form of syrup, to be slowly swallowed, in doses of one or two teaspoonfuls. The dose of the root in substance is half a drachm or more. It may be given scraped into a soft mass, or well bruised. It may also be administered in infusion.

Infusion of Horse-radish (INFUSUM ARMORACIÆ, *U. S.;* INFUSUM ARMORACIÆ COMPOSITUM, *Lond.*) is prepared by macerating an ounce of horse-radish, and the same quantity of bruised mustard-seeds, in a pint of boiling water. The dose of it is two fluid-ounces, three or four times a day.

A *Compound Spirit of Horse-radish* (SPIRITUS ARMORACIÆ COMPOSITUS, *Lond.*) is directed by the London College to be prepared by distilling proof spirit from horse-radish, orange-peel, and nutmeg. It is an elegant stimulant diuretic, and may be added to diuretic infusions or mixtures, when it is desirable to render them more stimulating to the stomach, the system generally, and the kidneys. It is peculiarly adapted to dropsical affections occurring in drunkards. The dose is from one to four fluidrachms.

II. MUSTARD.—SINAPIS. *U. S., Lond., Dub.*—SINAPI. *Ed.*

Of mustard I shall treat at large with the rubefacients. I have already considered it as emetic and laxative. (See *pages* 443 and 468.) Its general effects on the system are closely analogous to those of horse-radish; being stimulating to the stomach, circulation, and emunctories, especially the kidneys, and consequently acting occasionally as a diuretic. In this capacity, it is also used under the

same circumstances; and, indeed, is generally given in dropsy, associated with that medicine, in compound infusion. (See *Infusion of Horse-radish*, above.)

A convenient form for the administration of mustard as a stimulating diuretic is that of *mustard-whey*, made by boiling an ounce of the bruised seeds or powder in a pint of milk, and straining. The dose is a wineglassful, several times a day.

A *compound infusion* has been considerably used in dropsy with an enfeebled state of the system, prepared by macerating in four pints of hard cider, an ounce, each, of juniper berries, mustard seeds, and ginger root, all well bruised, and two ounces, each, of parsley root and horse-radish, also bruised. The dose is a wineglassful, four times a day, gradually increased if required.

III. GARLIC.—ALLIUM. *U.S., Ed.*

This has already been considered as a nervous stimulant. When its oil is absorbed, it passes out by the kidneys, as well as other emunctories, and sometimes operates with considerable activity as a diuretic. It may be used in dropsy, under the same circumstances as horse-radish and mustard; and, moreover, in cases of that disease associated, as it not unfrequently is, with chronic bronchial disease, in which garlic sometimes acts usefully as a stimulating expectorant. It may be administered in substance, bruised, or in the form of syrup. (See *Allium*, i. 624.)

CLASS IV.

DIAPHORETICS or SUDORIFICS.

DIAPHORETICS are medicines which increase perspiration. This secretion is always going on in health, though, in consequence of the vaporization of the liquid at the moment of elimination, it is ordinarily insensible. Any one may convince himself of this, by holding the palm of his hand against a window-pane, in cold-weather. The glass quickly becomes covered with the condensed moisture. Whether the perspiration shall be insensible, or sensible in the form of sweat, depends partly on its quantity, and partly on the condition of the atmosphere in relation to moisture or dryness. When the air is very dry, the perspired fluid is instantaneously evaporated after extravasation, and, though possibly in considerable quantity, is quite insensible. On the contrary, in a very moist condition of the atmosphere, the escape of the perspiration in the aeriform state may be entirely prevented, and, even without any increase of secretion, the surface of the body may be bathed in sweat. There is consequently no difference in the function in these two opposite states of the surface; and the division formerly made of this class of medicines into *diaphoretics* which promote the insensible, and *sudorifics* which promote the sensible perspiration, is without any foundation in fact.

1. *Mode of Operation.*

Diaphoretics may operate either by stimulating the perspiratory function, or by relaxing the vessels of the surface, or by both methods jointly. They also operate by increasing the flow of blood through the skin, and the fulness of the blood-vessels.

1. *By Stimulating the Perspiratory Function.* The true function of perspiration is probably performed by the cell-structure of the sudoriferous follicles, and, like every other function, is capable of being excited or depressed by agents, calculated to act upon the peculiar susceptibilities of the tissue performing it. Certain diaphoretics have the property of stimulating the secreting tissue, and of thus increasing the secretion. It is not impossible that such a

stimulation may be exercised sympathetically, by an impression first made on the mucous coat of the stomach or elsewhere, and thence transmitted through nervous centres to the skin. I do not know any medicine of which this mode of action can be predicated with certainty, or even great probability; but heat undoubtedly, I think, acts in this way. On this point more will be said directly.

The probability is, that all the diaphoretic medicines which act by stimulating the function, do so directly by contact with the secreting tissue, to which they are conveyed with the blood, after having been absorbed. There are certain medicines which appear to have a special tendency to operate upon the perspiratory function; or, to speak more precisely, to the influence of which this function is peculiarly or specially susceptible. These medicines are preeminently diaphoretic. There are others, which, in consequence of their irritant properties, cannot be tolerated in the circulation, and are thrown off indifferently by the emunctories intended to purify the blood, or by that one of them to which circumstances particularly direct their action. These medicines may be diaphoretic, diuretic, or purgative, according to the character of the influences with which they may be conjoined. They will often operate powerfully as diaphoretics, when aided by certain states of the system, and certain modes of administration. As the skin and kidneys are the chief emunctories for the elimination of absorbed and unacceptable matters in the blood, the substances just referred to usually escape through one of these routes, and, in doing so, stimulate the functions respectively, and consequently produce either diaphoresis or diuresis. But, as previously explained in the general observations on diuretics, there is a certain antagonism between these functions, through which it happens that, if one is promoted in excess, the other is proportionably diminished, and if one is diminished, the other is promoted. Consequently, medicines are seldom decidedly diaphoretic and diuretic at the same time. It has been before stated that cold has a tendency to suppress perspiration, and to direct action to the kidneys. The medicines now referred to will, therefore, prove diuretic when cold is made to cooperate with them. Heat, on the contrary, has the direct effect of determining to the surface. Hence they become diaphoretic when assisted by this agent.

There is, to a certain extent, a similar antagonism between the skin and the bowels. If the medicines now under consideration be given conjointly with cathartics, even though absorbed, they will

often aid in the cathartic effect rather than operate either on the skin or kidneys; but, combined with opium, which restrains catharsis, while it stimulates the perspiratory function, they will prove powerfully diaphoretic, especially if aided by warmth.

2. *By Relaxing the Vessels of the Skin.* There is certainly a great difference, at different times, in the vital cohesion or tone of the small blood-vessels, according to the varying influences to which they are exposed, which very much affects the amount and rapidity of the transpiration through them of the watery portion of the blood. With their healthy degree of tone or firmness, only such an amount of liquid escapes as is necessary to give due softness and lubricity to the tissues. When, however, they become feeble and relaxed, the watery parts of the blood pass through them with little resistance, and often in great abundance. Hence the copious night-sweats of debility, occurring when, in consequence of sleep, the organic functions are in their lowest state of activity. Hence, too, the cold sweats with which the body is often bathed in the last stage of vital prostration. Now, whatever agency, in the state of health, produces a similar relaxation of the cutaneous vessels, may occasion a similar transudation of liquid, and thus act as diaphoretics. All nauseating substances have this property. Nothing is probably so relaxing to the surface as a state of extreme nausea. Hence the nauseating emetics are all, in certain doses, diaphoretic. It is not, however, the proper secretory function of perspiration, or the activity of the sudoriferous cells, which they promote; but only the exosmotic transpiration. Nevertheless, they are often equally efficient as remedies.

If, with the relaxed condition of the capillaries or small blood-vessels just referred to, there be a more rapid current of blood through the vessels, or a greater distention of them, the transpiration must be increased, because the proportion of liquid from which it proceeds in a given time is increased. Hence the night-sweats of phthisis and other states of debility are usually greatest, when, along with a certain amount of relaxation, there is a frequent pulse. If, then, one of the nauseating and relaxing diaphoretics be accompanied with some influence which shall increase the flow of blood through the vessels, or the bulk of liquid in them, its action will be greatly promoted. In this way, in part, may be explained the powerful diaphoretic influence of Dover's powder; the opium stimulating the movement of the blood through the capillaries, while the ipecacuanha relaxes their coats.

In the febrile state, the skin is usually hot and dry, while the blood flows through it more copiously, and more rapidly than in health. The tissue is excited beyond the point at which it can perform the function of perspiration. The effect is only in obedience to the universal law, that a moderate stimulation increases function, a greater deranges it, and a still greater diminishes or suspends it. The last condition is present in the state of fever alluded to. It is not only the cell-function that is suppressed, but the transpiratory also, in consequence of the excessive cohesion of the vascular coats under the excessive irritation. Now all that is wanting, in such a case, is to reduce the excitement to the first condition above mentioned, that, namely, at which function is increased; and copious perspiration will take place. The follicles will secrete, and the vessels transpire, beyond the mean amount. Hence, refrigerating and relaxing substances act powerfully as diaphoretics in the febrile state. Tartar emetic and citrate of potassa operate partly in this way; and a draught of cold water, or sponging the excited surface with cool liquids, by which the excitement is reduced, are often followed by a gentle perspiration. A warm bath, or sponging with warm water, has a similar effect by the direct relaxing influence of the moisture.

3. *By the Two Methods Jointly.* Some medicines combine the two modes of action above considered. They at once stimulate the cell-function by which they are eliminated, and relax the coats of the vessels so as to favour transudation. The antimonials and ipecacuanha may be supposed to act in this way. By a slight nauseating impression on the stomach, scarcely sensible to the patient, they sympathetically relax the vessels; while, by entering the circulation, and coming into contact with the sweat-producing cells, they stimulate them into greater activity. If now, some influence be added which will augment the rapidity of the flow of blood in the part, and fill the vessels beyond the normal degree, the effect is still further augmented. Such an influence is obtained by the addition of opium, the application of warmth, and the free use of water.

4. *By Filling the Cutaneous Vessels.* Little more need be said upon this method of producing diaphoresis than what has been above incidentally stated. No fact in physiology is better established, than that distention of the vessels, favours the elimination of their contents. This condition is produced by the free use of drinks, which are absorbed almost as rapidly as swallowed. But

it is the whole general circulation that is affected. If circumstances call some one eliminating function into especial action, it is through this that the liquid escapes. Warmth directs to the skin. Hence the drinking of warm or hot water is a powerful promoter of perspiration.

5. *Increased Rapidity of the Current.* This also has been incidentally mentioned as among the influences promotive of the perspiratory function. More blood is offered in a given time to the cells, which are also excited by its presence; while the transuding process must go on with proportionate increase of rapidity, if the tonicity of the vascular coats is not augmented. Hence, simple stimulation, directed especially to the skin, often produces a powerful diaphoretic effect, if kept within due bounds. Beyond a certain point, it will derange or check the function. Hence the additional efficiency given to water by heat and gently stimulating substances, such as the milder aromatics. Hot herb teas are notorious for their powerful diaphoretic action. *Balm*, the *mints*, *sage*, *catnep*, *chamomile*, and *eupatorium*, given in hot infusion, while the patient is kept warm in bed, operate very efficiently in this way; and are often given with advantage at the commencement of certain inflammatory affections, particularly catarrh and rheumatism.

2. *Therapeutic Effects.*

1. Diaphoretics are often useful by *relieving the heat and dryness of the surface*, which is so common in febrile diseases, whether idiopathic or symptomatic, and which operates injuriously upon the disease, by its irritant reaction on the system. Upon this principle alone, were there no other ground for their use, they would prove beneficial in all cases of *fever with a hot, dry skin.*

2. They *deplete from the blood-vessels*, and sometimes very copiously. It is not only the watery parts of the blood that are carried off under their influence, but the salts, and, to a certain extent, the organic constituents also. Hence, copious sweating is very debilitating. Every one knows how exhausting to the strength are the night-sweats of hectic and of convalescence. From this effect of diaphoretics, they may often be serviceably employed in *inflammatory and febrile diseases*, in which the blood is too rich, and the general condition of the system sthenic.

3. Diaphoretics *promote absorption* by their depletory influence, and on this principle are sometimes used very happily in *dropsy.* I have known severe dropsy to yield to this class of medicines, in which diuretics had been employed without effect.

4. They *act revulsively* towards the surface of the body from the interior organs. In this way, they are useful in all the *interior inflammations and vascular irritations;* but are especially efficacious in inflammatory conditions of the mucous and serous tissues, as in *bronchitis*, *enteritis*, *dysentery*, *peritonitis*, &c. It is probably upon this principle, partly, that they act favourably in the different forms of *rheumatism*. In *morbid diuresis* and in *diarrhœa*, they also act favourably by diversion to the surface, and substituting one discharge for another. In *eruptive affections*, whether febrile or not, diaphoretics sometimes serve an excellent purpose, upon this principle of derivation, by inviting a retarded or repelled eruption to the surface, and thus relieving internal irritation.

5. They *eliminate noxious matters* from the blood, and may often possibly operate usefully in this way, when given to meet other indications. Little, however, is known with certainty and precision upon this point. It is probable that they act usefully upon this depurating principle, in *gout*, *rheumatism*, and various *idiopathic fevers*. In *calculous affections*, also, when acid in the circulation may dispose to the deposition of uric acid in the urine, it is possible that diaphoretics may prove useful, by eliminating the offending matter through the skin.

6. Certain diseases show a tendency to pass off with copious sweating. It has been thought that nature might be advantageously imitated by the use of diaphoretics, and an earlier solution of the disease thus obtained, than if it were left to its ordinary course. There is probably some ground for this supposition. In *miasmatic fevers*, I have little doubt that we may thus often lessen the duration, and effect a more complete solution of the paroxysms; converting an almost continuous fever into a distinct remittent, a remittent into an intermittent, and a doubtful intermittent, with long paroxysms, into one in which the apyrexia is more complete, and the paroxysms shorter.

7. It sometimes happens that the skin falls into an inactive or torpid state, and ceases to perform its function properly; in consequence of which, the blood may become impure, and various internal irritations, whether of a vascular or nervous character, may arise. There is here an obvious indication for the use of diaphoretics, and especially those of a somewhat stimulating character. It is in this way, probably, in part, that the stimulating diaphoretics prove useful in *chronic rheumatism*, *scrofula*, *secondary syphilis*, and other *cachectic conditions* of the system.

3. *Administration.*

If copious perspiration is desired, the patient should be confined to bed, and clothed with light flannel or other woollen tissue next the skin, or placed between woollen blankets. The reason for this is that wool, on account of its slow power of conduction, prevents the rapid escape of heat, and obviates the danger of accidental exposure of the surface, and a consequent premature checking of the perspiration.

If the pulse is full and strong, and the general excitement considerable, it will generally be advisable to precede the diaphoretic by measures calculated to diminish plethora, and reduce action, so as both to favour the absorption of the medicine, and to bring the cutaneous excitation down to the secreting point. For this purpose, the appropriate measures are bleeding, when called for by other considerations also, the saline purgatives, the antimonials with a view to their sedative influence, and a low diet.

If it is desired that the diaphoretic should act profusely, it ought to be accompanied with warm diluent drinks, as balm tea, hot lemonade, hot molasses and water, &c., or some one of the gently stimulating infusions already mentioned.

During the continuance of the diaphoresis, purgation and diuresis should, as a general rule, be avoided, and, if existing, should be suppressed by appropriate measures, as by warmth in reference to the latter, and by opiates in reference to both.

HEAT AND WATER AS DIAPHORETICS.

The reader is already familiar with the effect of heat in promoting perspiration. Why this power should have been given to it, will be rendered obvious by a moment's consideration. Heat above the normal standard is injurious to the system, and must be abated. Perspiration, through the evaporation of the liquid upon the surface, at the moment of elimination, and the consequent absorption of free heat in the vapour, has the effect of reducing or keeping down the temperature of the surface, and secondarily of the system at large. Now, the perspiratory function has been made such, in its susceptibilities, as to feel and respond to the influence of heat, whether applied directly to the skin, or operating on it through the nervous centres, from any other point of accumulation, especially the stomach. Hot water, therefore, taken into the stomach immediately brings on perspiration through this sympathetic action. When employed, however, as a diaphoretic agent, it is important

not to use it in excess, as otherwise we may overshoot the mark, and entirely suppress the function of the skin by over-excitement. In a state of health, there is scarcely any supportable degree of heat which will not cause perspiration; but, when the skin is already hot and dry, as in fever, the addition of heat will often only serve to aggravate the affection.

Exercise generally promotes perspiration. This happens in part because the current of blood is transmitted more rapidly through the skin; but the chief cause is probably the generation of heat by the exercise, which, should it be in excess, promotes perspiration in order that it may be reduced to the just point.

Dry heat will generally produce a diaphoretic effect; but this is much increased by the conjoint influence of moisture. Water favours diaphoresis by its relaxing effect upon the coats of the vessels, and, when taken internally, by adding to the volume of the blood. It, therefore, brings quite different agencies in aid of the heat, which operates only by increasing the current through the vessels, and immediately stimulating the function of the sudoriferous follicles. There are consequently few agencies more powerful as diaphoretics than that exercised by a combination of heat and water.

Of the different modes of applying heat, whether moist or dry, internally or externally, sufficient has been said either above, or under the head of the diffusible stimulants, to which the reader is referred. (See *vol.* i. *p.* 488 to *p.* 499.)

Therapeutic Application. Moist heat is often highly advantageous as a diaphoretic, at the very commencement of various inflammations, before the disease has become firmly fixed, or the febrile phenomena fully developed. This remark is especially true of *catarrhal and anginose affections*, and *acute or subacute rheumatism.* It is usually employed in such cases internally, in the form of hot teas, given at bedtime; but is equally effectual when externally used, as by a vapour bath. Care, however, is always necessary, in these cases, to avoid exposure to the cold next morning. I have known serious internal inflammation result from a neglect of this caution.

In *chronic inflammation*, and especially in *chronic rheumatism*, the sudorific influence of either dry or moist heat, externally employed, is often extremely serviceable. It may be used also in *chronic gout* and *chronic paralysis;* and, in *chronic skin affections*, it is among the most efficacious remedies to which we can have recourse.

It may be employed also to hasten the appearance of eruptions, and to invite the return of those which have been repelled.

In chronic *enteritis*, *diarrhœa*, and *dysentery*, chronic *calculous affections* connected with the deposition of uric acid, *obstinate dropsies* especially when dependent on disease of the kidneys, and all cases of obscure disease, in which the existence of a poison in the blood may be suspected, which there may be a hope of eliminating by the skin, indications are offered for the use of this remedy.

The diaphoretics may be arranged in three divisions, each characterized by distinctive properties; 1. the nauseating, 2. the refrigerant, and 3. the stimulating or alterative.

1. *Nauseating Diaphoretics.*

All emetic substances, which have the nauseating property in any considerable degree, are capable of operating as diaphoretics. In the condition of nausea, as explained in the preceding general observations, there is a universal relaxation of the cutaneous capillaries, by which the watery parts of the blood are permitted to ooze through their coats, constituting perspiration. Whether this transudation is a mere mechanical process, or regulated in some measure by the vital force, is a question which it would not be easy to solve; but this fact is evident, that it is not the unaltered liquor sanguinis that exudes, for the liquid neither coagulates spontaneously like fibrin, nor with the aid of heat like albumen. It, therefore, undergoes some modification in its passage, which is probably owing to the influence of the membranous tissue through which it oozes; but whether this influence is physical or vital has not been determined. Whatever may be the fact in this respect, the exudation appears to be quite distinct from the process by which the follicular cells elaborate the proper perspiratory secretion.

But these medicines will often produce a diaphoretic effect in doses insufficient to cause any sensible nausea. It is probable, nevertheless, that they still exercise on the nervous centres a degree of the same influence, which, though it may not be strong enough to give rise to the positive sensation of nausea, may occasion, in a slighter degree, the relaxation of surface characteristic of the nauseating influence.

There is, however, an additional method in which some, if not all of the nauseating diaphoretics operate. The perspiratory effect first mentioned results from a sympathetic impression made on the surface through the nervous centres. That now referred to proceeds from their absorption, and direct excitant influence on the

proper secretory structure of the skin. I have no doubt that tartar emetic at least operates in this double way.

Though all the nauseating medicines are diaphoretic, there are only two which are much used in this country, namely, tartar emetic, and ipecacuanha. The other preparations of antimony are sometimes employed, especially in Europe; and American practitioners occasionally resort to our indigenous emetics, as sanguinaria and lobelia; but all the advantages that are afforded by these substances as diaphoretics can be equally obtained from the two first mentioned, to which I shall confine my observations. For all that is necessary to be known in relation to the other antimonials, the reader is referred to the article on the preparations of antimony, under the arterial sedatives (ii. 78); and lobelia and sanguinaria will be found described among the emetics.

I. TARTRATE OF ANTIMONY AND POTASSA.

ANTIMONII ET POTASSÆ TARTRAS. *U.S.*

Syn. Tartar Emetic.

The mode of preparing this substance, its properties, effects on the system, and therapeutic applications as an arterial sedative, have been already fully considered (ii. 57). It is now to be treated of only as a diaphoretic. In this capacity, it is applicable to all cases of febrile and inflammatory disease, in which there is a sthenic condition of system, without irritability of the stomach, or inflammation of the small intestines. There might be danger, in this condition of the stomach and bowels, that it would add injuriously to the existing irritation by its contact with the membrane. Dysentery is not excepted from the general rule; because the medicine is probably, in great measure, or wholly absorbed before it reaches this part of the alimentary canal. In a typhoid state of fever, even though accompanied with a hot dry skin, I would not recommend it, as I should apprehend that it might still further injure the blood already impaired, and aid in depressing the already too much depressed forces of the system. It is especially contraindicated in *enteric* or *typhoid fever*, not only by its depressing property, but by its probable irritant action on the diseased ileum.

The dose of tartar emetic, as a diaphoretic, is from one-twelfth to one-quarter of a grain; one-sixth or one-eighth being the usual quantity used. The dose should be repeated every hour, two, or

three hours. Should it nauseate in these doses, they may be diminished; should it produce no effect whatever, they may be gradually and cautiously increased. Not unfrequently the antimonial disturbs the bowels; in which case a little laudanum, or other preparation of opium, may be given with it. The medicine is best administered dissolved in water. *Antimonial wine* may be substituted, if the watery solution cannot be had. From twenty minims to a fluidrachm is the diaphoretic dose for an adult.

II. IPECACUANHA. *U. S., Lond., Ed., Dub.*

For a general account of ipecacuanha the reader is referred to the emetics (ii. 433). As a diaphoretic it is very seldom given alone, and, when thus given, is not capable of producing any considerable effect, unless in doses which would discompose the stomach. I am, however, in the habit of using it in cases in which, without producing copious diaphoresis, it is desirable to keep the skin in a soft, rather moist state. In the second stage of enteric or typhoid fever, when the mouth and surface of the body are disposed to be dry, and the secretions generally are deficient, and in analogous conditions in other fevers, I am in the habit of giving very small and frequently repeated doses, conjoined with small doses of the blue mass. One grain of the mercurial preparation, with one-sixth or one-eighth of a grain of ipecacuanha, may be given every two hours, till some effect on the mouth is discovered, or occasion for its use no longer exists. The ordinary full diaphoretic dose is a grain, which may be repeated every four, six, or eight hours. If it nauseate in this quantity, the dose may be diminished, and repeated more frequently.

Ipecacuanha and Opium.—Conjoined with opium, ipecacuanha acquires great diaphoretic powers, which render this compound a most valuable medicine in numerous diseases. Some have supposed that but little of the power of this mixture is due to the ipecacuanha; the opium being, in their opinion, the main, or almost exclusive diaphoretic ingredient. But I am convinced that this is an error. Opium certainly will sometimes act with considerable energy as a diaphoretic; but it very often fails, and cannot alone be relied on. The addition of ipecacuanha is essential to the full diaphoretic effect; and powers are evolved by the combination which neither ingredient alone would exercise. This will be obvious when

its method of operating is considered. Opium stimulates the capillary circulation, and has some excitant effect on the proper perspiratory function; ipecacuanha relaxes the coats of the vessels so as to keep them within the transuding point, while it also stimulates the proper function; if now warm drink be added to fill the blood-vessels, we have a combination of all the most powerful diaphoretic influences.

The stimulant and narcotic properties of the opium limit the employment of this combination. It is true that these properties are somewhat modified by the ipecacuanha, so as to render the preparation applicable where we might hesitate to employ opium alone; but still they are by no means annihilated; and it would not be proper to administer the medicine in states of the highest inflammatory excitement, with a full, strong pulse, nor in others in which there might be active congestion or inflammation of the brain. In all such cases, the excitement should be lowered by depletory measures, and the cerebral symptoms removed, before venturing upon this diaphoretic.

Therapeutic Application. The combination of opium and ipecacuanha is peculiarly applicable to inflammatory complaints, after the reduction of excitement. It operates beneficially by revulsion to the surface, depletion, the relief of pain, and the quieting of nervous irritation, which always forms an essential part of every inflammation. It is especially useful when the inflammation is complicated with typhoid phenomena. In all these affections, it is very often associated with calomel or other preparation of mercury; which is usually indicated, if at all required in the case, at the same stage.

It is unnecessary to particularize the several phlegmasiæ in which the combination may be used. It may be given in all, with the exception of those of the brain, and of the bronchial mucous membrane, in which it is generally contraindicated, especially before free expectoration has taken place, by the effect of opium in checking the bronchial secretion. But those to which it is most applicable are *mucous enteritis*, *dysentery*, and *peritonitis*. As a general rule, it may be given every night at bedtime, after the third day of the disease, if the patient has been duly depleted. In typhoid cases, it may be given earlier.

In *acute rheumatism*, it is one of the remedies most relied on. After a few days appropriated to the requisite depletory measures, a full dose may be given every eight, six, or four hours, so as to sustain a steady diaphoretic and anodyne effect. In this complaint, also, it is very advantageously associated with calomel, with a view

to mercurialism, if the disease do not show a disposition to enter into convalescence in eight or ten days.

In *gout* it is often useful, in the full dose, given at bedtime.

In the course of the *idiopathic fevers*, when associated with disordered nervous phenomena, especially want of sleep, it may often be advantageously given at night, when not contraindicated by too high arterial excitement, or vascular irritation of the brain. In these fevers, when of the low or typhoid character, it is an excellent remedy, exhibited as a stimulant and diaphoretic, in small doses, at regular intervals, through the twenty-four hours.

It is one of the most efficacious remedies in *diarrhœa*, after the bowels have been disembarrassed of any irritating matter; and in the various *hemorrhages*, especially the uterine, when not attended with arterial excitement, it often answers an excellent purpose.

In some cases of *dropsy*, which have failed to yield to diuretics and purgatives, recourse may be had to this combination, which, by the profuse perspiration it produces, promotes absorption. It should be given every four, six, or eight hours, so as to sustain a constant and powerful effect, which should, moreover, be aided by the hot bath. I have seen dropsy of the most obstinate character yield completely to this treatment.

Administration. The full dose is a grain, each, of ipecacuanha and opium; which, when the object is to sustain a constant impression, may be repeated every six or eight hours, or even more frequently. Sometimes advantage will be found from dividing the dose, and repeating it more frequently. Very often the medicine is given only at bedtime; other remedies being used during the day. Sometimes, when the indication for its use is decided, but the stomach irritable, it may be exhibited in double the ordinary dose by enema. If given alone, or with calomel, the mixture is best administered in the form of pill; but a very frequent mode of exhibition is that of the powder of ipecacuanha and opium, or Dover's powder.

POWDER OF IPECACUANHA AND OPIUM.—PULVIS IPECACUANHÆ ET OPII. *U. S.*—PULVIS IPECACUANHÆ COMPOSITUS. *Lond., Ed., Dub.*—*Dover's Powder.*

This is made by rubbing together one part of opium, one of ipecacuanha, and eight of sulphate of potassa. The object of the sulphate of potassa is mainly, by the hardness of its spiculæ, to enable the two vegetable ingredients to be more thoroughly divided, and consequently more intimately incorporated; as it is thought

that the combination owes some of its peculiar efficacy to the thorough blending of the ingredients, so that it may be, as it were, one substance. Some have substituted nitrate of potassa, as being itself somewhat diaphoretic; but it appears to add nothing to the efficiency of the combination, and might sometimes render it less acceptable to the stomach.

This preparation is used for all the purposes above mentioned, to which the mixture of ipecacuanha and opium is adapted. It may be administered suspended in water, formed into an electuary with syrup, or in the form of pills. The dose is ten grains, containing a grain of opium and a grain of ipecacuanha.

The effects of the Dover's powder may be obtained by mixing thirty drops of ipecacuanha wine with about twenty-five drops of laudanum.

2. *Refrigerant Diaphoretics.*

In addition to their diaphoretic powers, these medicines are sedative or refrigerant in their influence on the system. Most of the alkaline salts, capable of absorption, have more or less of these properties. When taken into the circulation, they depress somewhat the action of the heart, and diminish the general heat, and escaping by the skin or kidneys, stimulate one or the other of these emunctories to increased action. If accompanied with the use of warm drinks they generally receive a direction to the skin, and prove diaphoretic. But there are a few which are disposed to act preferably on the surface even without accompaniment, and these may properly be considered as diaphoretics. It is to them that our notice will be restricted in this place.

I. CITRATE OF POTASSA.

POTASSÆ CITRAS. *U.S.*

Preparation and Properties. This salt is prepared by saturating a solution of citric acid with bicarbonate of potassa, and evaporating to dryness. The bicarbonate of potassa is preferred to the carbonate, because it is purer, as the latter is generally procured. The salt is susceptible of crystallization, but is usually prepared in the amorphous state. As kept in the shops, it is in the form of a white granular powder, inodorous, of a peculiar, saline, not unpleasant taste, deliquescent, very soluble in water, and insoluble in

alcohol. It is decomposed at a red heat, leaving a residue of carbonate of potassa. It is known to contain no tartrate, by not yielding a precipitate of bitartrate of potassa, on the addition of muriatic acid.

Medical Effects and Uses. In the ordinary state of the circulation, this salt cannot be depended on for diaphoretic operation; but, when the skin is hot and dry, and the circulation accelerated, there is no diaphoretic which operates more certainly and effectually. It appears to reduce the irritation of the surface to a point at which secretion can take place, while it directly stimulates the secretory function of the sudoriferous glands; and, as the vessels are full of blood, and the current rapid, we have the conditions most favourable to copious diaphoresis.

Either simply dissolved in water, or in the forms of the neutral mixture and effervescing draught, to be described immediately, it is admirably adapted to all cases of *inflammatory and febrile disease*, in which the *skin is hot and dry*. It is less powerfully depressing to the circulation than tartar emetic, and, therefore, not so effectual as an antiphlogistic remedy; but it is, I think, more certain as a mere diaphoretic. In the *paroxysm of our miasmatic fevers*, in the *febrile stage of yellow fever*, in all the *exanthemata*, and all the *phlegmasiæ*, it may be used advantageously, under the circumstances mentioned. In the *first week or two of typhoid fever*, and, indeed, throughout both that fever and the *typhus*, whenever the skin is hot and dry, it may be given with advantage, and without the fear of depression, such as, in the same condition, might be apprehended from the antimonials. Another great recommendation is its general acceptability to the palate and stomach.

Administration. The dose of citrate of potassa is from twenty to thirty grains, to be repeated every hour, two, or three hours, according to the violence of the fever. It should be given dissolved in from one to two fluidounces of water; but I much prefer it in one of the modes of extemporaneous preparation mentioned below.

1. SOLUTION OF CITRATE OF POTASSA, OR NEUTRAL MIXTURE.—LIQUOR POTASSÆ CITRATIS. *U.S.*

This is prepared by saturating fresh lemon-juice with carbonate or bicarbonate of potassa. Four fluidounces of the juice are a convenient quantity. The salt is to be slowly added until effervescence ceases. A solution of citric acid in water, flavoured with oil of lemons, may be substituted for the lemon-juice. (See *Citric Acid*, ii. 93.) The bicarbonate of potassa is directed in the Pharmacopœia,

preferably to the carbonate, because the latter is apt to contain impurities, especially silicate of potassa, which is decomposed by the citric acid, with the deposition of hydrated silica in a flocculent state. This, however, has no other disadvantage than its unsightliness; as it has no effect on the system. By the reaction between the carbonate or bicarbonate and the citric acid, in the preparation of the solution, citrate of potassa is formed, which remains dissolved, and carbonic acid is liberated, partly escaping with effervescence, and partly dissolved by the water; so that the preparation is a solution of citrate of potassa in water, impregnated with carbonic acid. When fresh lemon-juice is used, the solution has a slightly greenish colour, in consequence of changes in the organic constituents of the juice. It is, moreover, of variable strength, as the quantity of acid in lemon-juice varies. Nevertheless, if the juice be from good sound lemons, and have a very sour taste, the preparation will be sufficiently uniform for use; and it has seemed to me more agreeable to the palate and the stomach, than preparations made with the solution of citric acid.

Another mode of preparing the neutral mixture is simply to dissolve three drachms of citrate of potassa in four fluidounces of water. To give it a greater resemblance to that prepared in the former methods, a drop or two of oil of lemons may be first rubbed up with the citrate, and this may be dissolved in carbonic acid water, instead of pure water. Upon the whole, I prefer the solution made with fresh lemon-juice.

The dose of the neutral mixture is a tablespoonful, or half a fluidounce every two hours. The interval may be shortened to an hour, or extended to three or four hours, according to the severity of the fever. It should be diluted with at least an equal quantity of water, when administered. Some prefer the preparation made originally with a mixture of equal measures of lemon-juice and water, instead of the undiluted juice. The advantage of this is that the dose contains more absorbed carbonic acid, than when the preparation is diluted after saturation. Of the preparation made in this way the dose would of course be double, or a fluidounce. When a strong sedative impression on the circulation is desired, small quantities of tartar emetic may be added to the mixture, say one-twelfth or one-eighth of a grain for each dose. Should there be nervous symptoms, as restlessness, morbid vigilance, muscular twitchings, startings, &c., attendant on the hot dry skin which calls for the neutral mixture, a little sweet spirit of nitre or Hoffman's anodyne,

may be added to it with advantage. Not unfrequently the mixture slightly disturbs the bowels, or causes griping pain. In such cases, it may be very properly combined with a little laudanum, or solution of sulphate of morphia, which is often useful also by aiding the diaphoresis, and composing irritation. Sugar may be added, if desired, in order to render it more palatable.

2. EFFERVESCING DRAUGHT.—LIQUOR POTASSÆ CITRATIS EFFERVESCENS.

This is by far the most agreeable method of exhibiting citrate of potassa, and is particularly adapted to cases in which the stomach is irritable. Independently of its diaphoretic and refrigerant properties, it is one of the most effectual anti-emetic medicines. I know nothing equal to it in cases of fever with a hot skin, and a disposition to frequent vomiting. To produce, however, its best effects, it must be carefully prepared.

I always prefer it made with fresh lemon-juice, when this can be had of good quality. It should be expressed from the lemon at the time when used. A solution of carbonate of potassa containing two drachms of the salt in four fluidounces of water, or a solution of the bicarbonate of potassa, with three drachms in four fluidounces, must be prepared. A tablespoonful of lemon-juice is to be expressed, and diluted with an equal measure of water; a tablespoonful of one of the above solutions is to be added; and the whole stirred together. If the materials are of the right quality, a brisk effervescence takes place; and, in this state, the dose should be swallowed. It need scarcely be said that the effervescence is owing to the escape of carbonic acid. The mucilaginous matter of the juice detains the acid gas for a short time, and thus increases the quantity of it swallowed. Sometimes no effervescence takes place. This is almost always owing to weakness of the lemon-juice, in other words, to its deficiency in citric acid. There is not enough of this to decompose the whole of the carbonate of potassa, and the consequence is that the liberated carbonic acid, instead of escaping with effervescence, goes to the undecomposed portion of the carbonate, and converts it into bicarbonate. This does not, however, happen, if the solution of the bicarbonate is used in preparing the draught. There can be no such appropriation of the liberated acid in this case, and if there is any acid in the lemon-juice, there will be effervescence of course. Some prefer the bicarbonate on this account. But it is not undecomposed bicarbonate of potassa that is wanted; it is the citrate; and

a brisker effervescence cannot compensate for a deficiency of this. The carbonate of potassa has the advantage of indicating, by this want of effervescence, the deficiency of citric acid in the lemon-juice, and thus enables us to correct it by the addition of a little more lemon-juice, or as much as may be necessary duly to excite effervescence. With the bicarbonate the deficiency passes undetected. I prefer, therefore, the carbonate of potassa in making this preparation. If fresh lemons are not to be had, a solution of citric acid may be substituted, of the same strength. (See ii. 93.)

The dose as above prepared should be administered every hour, two, three, or four hours. Every two hours is generally sufficient. To this, as to the neutral mixture, additions may be made to meet coexisting indications, as tartar emetic to increase its sedative powers, sweet spirit of nitre to obviate nervous symptoms, and one of the liquid forms of opium, especially the solution of sulphate of morphia, to obviate diarrhœa and quiet nervous irritation.

II. SOLUTION OF ACETATE OF AMMONIA.

LIQUOR AMMONIÆ ACETATIS. *U.S., Lond., Dub.*—AMMONIÆ ACETATIS AQUA. *Ed.*

Syn. Spirit of Mindererus.—Spiritus Mindereri.

Preparation. This solution is prepared by saturating diluted acetic acid with carbonate of ammonia. The latter is gradually added to the former, until effervescence ceases, and the acetic acid is saturated. The resulting preparation is a solution of acetate of ammonia, impregnated with carbonic acid, a portion of which is retained by the liquid, when disengaged from the carbonate. It was formerly made with common vinegar, and often impure carbonate of ammonia, and had a dark-brown colour, and empyreumatic odour. It is still occasionally prepared with distilled vinegar; but this is objectionable, as of uncertain strength, and, in consequence of some organic matter contained in it, sometimes causing the liquid to be brown. The solution may, however, be deprived of colour by filtration through animal charcoal.

Properties. When quite pure, it is colourless, and, if the saturation is exact, has no smell. An acetous odour, however, is much preferable to an ammoniacal, as the former would indicate an excess of acetic acid, which, if moderate, is harmless; the latter an excess of the carbonate, which is objectionable on account of its

stimulant properties. The taste is saline and disagreeable. By heat, the solution is dissipated, without residue. It is decomposed by solution of potassa and the stronger acids; the former evolving an odour of ammonia, the latter of vinegar. The salts of iron redden it, and, with a solution of nitrate of silver, it causes the formation of crystals of the acetate of that metal. When long kept, with access of the air, it undergoes decomposition, and a portion of carbonate of ammonia is formed. It should be prepared as wanted for use.

Medical Effects and Uses. The solution of acetate of ammonia was known to Boerhaave, but was brought into notice somewhat later by Minderer, whence it derived the name of spirit of Mindererus. It is somewhat sedative or refrigerant in its effects, and operates as a diaphoretic in febrile states of the system. It is said to prove diuretic, if the patient be kept cool, and walk about during its use. Some have supposed it to be stimulant; but there is no sufficient evidence of its possessing that property.

It is used for the same purposes, and in the same complaints as the neutral mixture; but, according to my observation, is greatly inferior to it both in diaphoretic power, and in the property of calming irritability of stomach. In my earlier practice, I used it a good deal in febrile diseases, but found it almost uniformly so much inferior to citrate of potassa, and so much less acceptable to the patient, that I have long ceased to use it, except in those rare cases, in which, from idiosyncrasy of stomach or palate, or unpleasant effects on the bowels, the neutral mixture or effervescing draught could not well be given. It is thought by some to be sedative in its influence on the uterus, and to be beneficially used in painful menstruation.

Locally, it has been thought to possess discutient properties, and been applied by means of compresses upon various kinds of tumours. It has also been used as a collyrium in chronic ophthalmia, being diluted with seven parts of rose-water.

The dose is half a fluidounce every two hours, which may be taken with a fluidounce of sweetened water, or carbonic acid water.

III. NITRATE OF POTASSA.

POTASSÆ NITRAS. *U. S., Lond., Ed., Dub.*

Syn. Nitre.

This has already been considered among the arterial sedatives, and diuretics (ii. 83 and 595). It certainly has, under ordinary circumstances, a much greater tendency to act on the kidneys than the skin; but, when given with more decided diaphoretics, or when conjoined with warm drinks, and the external application of warmth, it sometimes acts with considerable energy in promoting perspiration. It is almost never given alone for this purpose; but is not unfrequently prescribed in connexion with tartar emetic, and occasionally with ipecacuanha and opium. The complaints in which it has been most frequently employed are *bilious fever* and *acute rheumatism*. In the former affection, it was at one time much used in the form of the *nitrous powders* (ii. 91); and, in the latter, it is still not unfrequently given, either in the nitrous powders, in solution with tartar emetic, in the Dover's powder as a substitute for sulphate of potassa, or associated with powdered guaiac, ipecacuanha, and opium.* The dose is from five to fifteen grains, which may be repeated every hour or two hours.

IV. SPIRIT OF NITRIC ETHER.

SPIRITUS ÆTHERIS NITRICI. *U. S., Lond., Ed.*—SPIRITUS ÆTHERIS NITROSUS. *Dub.*

Syn. Sweet Spirit of Nitre.—*Spiritus Nitri Dulcis.*

This preparation has also been treated of among the diuretics (ii. 598), with which, probably, like the preceding medicine, it has a greater affinity than with the diaphoretics. But, like nitre, it will occasionally aid other more efficient diaphoretics, and, if itself assisted with internal and external warmth, and free dilution, will often act with considerable energy on the skin. It is, however, more used, along with other diaphoretics, to meet some coexisting

* The following is a good formula in certain cases of acute or subacute rheumatism, in which the disease lingers, after the activity of the symptoms is passed. Take of powdered opium, powdered ipecacuanha, each, six grains; powdered nitrate of potassa two drachms; powdered guaiac three drachms. Mix well together, and divide into twelve powders. Give one every four hours.

indication, than merely with a view to promote perspiration. With its influence on the secretions it unites, in a considerable degree, the properties of a nervous stimulant, with less excitant effect on the circulation than most of the medicines belonging to that class, and therefore better adapted to cases in which there may be considerable febrile excitement. In the febrile diseases of children, and in those of a typhoid character in adults, there is often much functional nervous disorder, as restlessness, wakefulness, twitchings of the tendons, starting in sleep, mental irritation, fretfulness, &c., which sweet spirit of nitre, operating as a nervous stimulant, often very happily allays. In infants, especially, it will afford striking relief, and seems sometimes to ward off attacks of convulsions, when associated with the diaphoretic medicines employed in their febrile attacks. Even when convulsions occur, this medicine may be given in the intervals of the paroxysms with happy effects. It is most frequently associated with small doses of tartar emetic, and with the neutral mixture or effervescing draught. From thirty minims to a fluidrachm may be given every two or three hours to an adult, from ten to thirty drops to young children.

3. *The Stimulant Diaphoretics.*

Medical writers have generally treated of various substances as stimulating diaphoretics, which, though they undoubtedly will occasionally promote the perspiratory function, when aided by warm dilution, have quite as great a tendency to other excretory functions, especially that of the kidneys, and are used more as alteratives than in reference either to their diaphoretic or diuretic powers. Such are *sarsaparilla*, *guaiac*, *mezereon*, and *sassafras*. These have all been fully considered among the alteratives (ii. 399 to 411), where, I think, they belong more strictly than to the present place.

PRICKLY ASH.—XANTHOXYLUM. *U.S.* We have, in the bark of a small indigenous tree, the *Xanthoxylum fraxineum* or *prickly ash*, a medicine closely analogous, in its properties and effects, with those just mentioned, particularly with guaiac and mezereon, and like them, sometimes used in chronic rheumatism. It is usually given in decoction; an ounce of it being boiled with three pints of water to a quart, of which one half may be administered, in divided doses, through the day.

VIRGINIA SNAKEROOT.—SERPENTARIA VIRGINIANA. *U. S.* This might also rank with the stimulating diaphoretics; but has been treated of among the tonics, to which it more especially belongs (i. 300). As its properties and uses as a diaphoretic are scarcely separable from those which rank it with the tonics, they have been already sufficiently considered, and it is only necessary here simply to call attention to them.

Most substances having a stimulant influence on the circulation, and capable of being absorbed into the blood, may be made to operate as diaphoretics by directing their action towards the surface of the body; and prove more or less serviceable by this property. But in all these, when considered elsewhere, this particular property and their uses in reference to it, have been sufficiently treated of, and to repeat the same statements here would be a useless waste of space.

CLASS V.

EXPECTORANTS.

THESE are medicines which cause or facilitate the discharge of secreted liquids from the lungs, including the larynx, trachea, bronchia, and pulmonary air-vesicles. They operate in several distinct methods. To understand their effects, it is necessary to bear in mind that, in the air-passages, as in the skin, there are probably two distinct extravasations, one of which is a true secretion, produced by the epithelial cells of the mucous membrane, and constitutes the bronchial mucus, the other a mere exhalation, partly liquid and partly vapour, through the coats of the capillaries and the basement membrane.

1. *Modes of Operation.*

1. There are medicines which appear to have the property of directly stimulating the true bronchial secretion, by contact with the secreting structure, to which they are brought with the blood, having entered the circulation by absorption from the stomach, or other surface of application. Such are squill, seneka, ammoniac, &c. It is not impossible that they may act through sympathy between the gastric and bronchial mucous membranes; but we have no proof that this is the fact; and analogy would lead to the conclusion, that they operate solely by direct contact, at least in their capacity of stimulants to the secretory function. The matter expectorated under their influence is usually a somewhat opaque mucus, showing that they increase the exfoliation of the cells, along with the production of the proper mucus, and thus merely augment the normal action of the membrane. Some, if not all of them, have the property of exciting also other secretory functions; but, with a few exceptions, their characteristic tendency is to the air-passages.

2. The blood-vessels of the bronchial mucous membrane, and of the pulmonary air-cells, are often irritated and actively congested beyond the secreting point. Hence the dryness of the membrane, and the want of expectoration, in the early stage of bronchitis. If the excitation be somewhat reduced, without being entirely suppressed, it may be brought to the point, at which the proper func-

tion is merely stimulated by the increased supply of blood, and the secretion will now be restored, and in a degree beyond the normal amount. But it is not only the proper secretion that is increased. The same thing happens necessarily to the simple elimination or exhalation through the coats of the vessels, and the watery discharge is consequently augmented along with the proper mucus. In this way, nauseating substances, and the arterial sedatives, operate not unfrequently as expectorants. Under the influence of nausea, the vessels of the lungs, like those of the skin, become relaxed; and, under that of the arterial sedatives, the force of the circulation is directly reduced. Ipecacuanha and lobelia, act in the former method, tartar-emetic probably in both. But, as these medicines enter the circulation, it is probable that they also have a direct influence on the secretory function, though not greater than that which they exercise on other functions, especially that of the skin.

3. Anything which moderately excites the circulation in the lungs and air passages, may prove expectorant. Both the secretory function is stimulated by the more copious supply of blood; and the pulmonary exhalation is increased by the fulness of the vessels. Some persons always expectorate after a meal, which gently excites the general circulation. Laughter often produces the same effect, to a very considerable extent, by stimulating especially the circulation of the lungs. I have often known copious expectoration to come on after hearty fits of laughter; which, therefore, may serve as a useful remedy in chronic bronchitis. Sometimes the exercise of the chest in speaking has a similar influence. The operation of the special stimulants of the bronchial secretion, is no doubt augmented by the property, which some of them have, of moderately stimulating the circulation also. They not only excite the cells themselves, but furnish more abundantly the material upon which they operate.

4. There is another altogether distinct method in which expectoration is promoted. The medicines which operate in this way do not increase the amount of matter thrown out into the air-passages; but, on the contrary, sometimes diminish it. Not unfrequently, in the advanced stages of pulmonary disease involving the bronchial tubes, and in the chronic condition of the same affections, there is a superabundant production of bronchial fluid, more than can be conveniently discharged, and sometimes very much embarrassing respiration, and endangering life. This is generally, under the circumstances mentioned, the result rather of a relaxed

and debilitated state of the tissue than of its undue excitation. It may be compared to the colliquative sweats, diuresis, and diarrhœa of debility. To correct this condition, and enable the lungs freely to expectorate the contents of the tubes and air-cells, the quantity of liquid must be reduced. This effect is produced by the stimulant expectorants. It has been suggested that they might act by causing the absorption of a portion of the exuded liquid, and thus bringing it within the capacity of the lungs to manage. But it is scarcely probable that a copiously eliminating tissue can be made also to absorb actively. Nor have we any proof that mucus is capable of being reabsorbed. The probability is, that the expectorants act simply by stimulating the bronchial membrane, perhaps sometimes altering its condition, thereby diminishing the amount of elimination. The vessels and secretory cells, having more vital cohesion or tonicity, under the influence of the medicine, become more retentive; and, the amount of extravasation being diminished, the lungs gradually throw off that already accumulated. The expectorants here have this advantage over simple general stimulants, not only that their influence is more directly exerted upon the secreting tissue, but that, being special excitants of the function, they do not abolish it, and thereby endanger congestion of the lungs; but, after having reduced it within due limits, sustain it in a state of moderate augmentation, calculated to relieve the diseased condition of the membranes. Squill, seneka, ammoniac, assafetida, and the balsams often act usefully in this way.

5. Another method in which relief is often afforded in pectoral diseases, associated with great debility, is by stimulating the muscular function. In paralytic and otherwise low states of the system, it not unfrequently happens that the patient has insufficient muscular power to throw off from the lungs the secreted matters with which they may be loaded; and death is inevitable unless relief can be obtained. This condition exists in the advanced stage of severe bronchitis and pneumonia, particularly in infants, and is very common in phthisis. The medicines which now operate as expectorants are those which stimulate the nervous centres, so as to give greater energy to the muscles of respiration. Wine-whey or other preparation of alcohol is here useful; but the most efficient remedies are those, which, with a stimulant power, have, in some degree, a special tendency to the lungs. Such are carbonate of ammonia, assafetida, garlic, and the oil of turpentine. These not only increase

the muscular power, but tend also to control the bronchial or pulmonary affection, in which the difficulty originates.

6. *Local applications*, made to the bronchial mucous membrane, sometimes favour expectoration; and, according to the state of the affection, and the nature of the substance used, may be made to answer most of the above indications. They are applied by inhalation. In somewhat excited and dry conditions of the bronchial membrane, the inhalation of *watery vapour*, at a rather low temperature, so as not to be excitant through the heat, may, by relaxing the vessels, sometimes favour secretion. In a somewhat atonic condition, on the contrary, the same effect often follows the inhalation of stimulant substances, in moderate degree, as chlorine very much diluted, the vapours of iodine, those of tar, and the fumes from burning resin. These are also useful in that condition in which the secretion is too abundant, in consequence of excessive relaxation or weakness of the tissue.

2. *Therapeutic Indications.*

In an acutely irritated or inflamed state of the air-passages from the larynx downward, the nauseating or relaxing expectorants, such as ipecacuanha, or tartar emetic, are indicated, and are among the remedies most constantly resorted to. This condition is presented in the earlier stages of *common catarrh*, *special laryngo-tracheitis*, and *bronchitis*, *measles*, *hooping-cough*, and the different *pectoral inflammations* attended with bronchial irritation.

In a somewhat more advanced stage, when the activity of the inflammatory excitement has abated, but expectoration is defective, the direct expectorants, which are too excitant for the earlier period of the disease, may be resorted to with much advantage, to aid in unloading the still congested vessels. In this condition, squill and seneka may often be advantageously used. They are too stimulating, in their local action, for the state of highest excitement. Should any doubt be entertained as to the sufficient subsidence of the inflammation, they should be combined with the medicines of the first class, which, by their relaxing influence, may obviate an over-stimulation of the vessels.

In a still more advanced stage of the same affections, when the membrane is enfeebled, and either with or without a free expectoration, and in chronic, laryngeal or bronchial diseases of the same kind, the stimulant expectorants are decidedly indicated, in order to give vigour to the membrane, and enable it to resume its healthy

condition. It is not impossible that some of the expectorants, adapted to this stage, exert also an alterative influence over the membrane, favourable to its restoration to health. The aim of the practitioner should always be to graduate the degree of excitation to the apparent state of debility, and to select the more or less stimulant expectorants accordingly. Among the least so are squill and seneka, among those of greater stimulant power, though probably less efficient as mere expectorants, are ammoniac, assafetida, garlic, carbonate of ammonia, &c. Advantage will often accrue from combining the two sets together, whereby the mere expectorant properties of the one, and the more stimulating of the other, may be obtained in conjunction. *Bronchitis* and *pneumonia*, in their very advanced stages, particularly after the occurrence of suppuration; the same affections less advanced, occurring in much enfeebled constitutions, or associated with typhoid disease; and chronic catarrhal affections attended with excessive mucous or muco-purulent secretion, as in *bronchorrhœa*, *catarrhus senilis*, and *humoral asthma*, are complaints which offer indications of the kind alluded to.

In all cases in which the lungs are likely to be overwhelmed by secretion or liquid accumulation in the bronchia and air-cells, or in pulmonary cavities, which the patient has not the muscular power to discharge, there is an indication for the most stimulant of the expectorants, and those calculated to operate with special force on the nervous centres, as carbonate of ammonia, assafetida, and garlic.

Still another indication which the expectorants fulfil, is, by the production of copious secretion into the air-cells, and bronchial passages, to act both depletorily and revulsively upon the inflammation of the proper tissue of the lungs, and even that of the pleura. Hence their utility in *pneumonia* and *pleurisy*, independently of the good effects they produce, in those complaints, in the relief of the accompanying bronchial irritation.

3. *Administration of Expectorants.*

Under this head very little remains to be stated. An important rule, it will be remembered, is to graduate the remedy, in relation to its want or possession in various degrees of stimulant power, to the stage and state of the disease; the relaxing or depressing members of the class being employed in the height of inflammation; those somewhat stimulant after the subsidence, or in the absence of high inflammatory excitement; and the most stimulating in cases

of unmixed debility. In doubtful cases, or intermediate stages, it is a good rule to combine the expectorants belonging to the two divisions between which the doubtful indication lies; as ipecacuanha or the antimonials with squill or seneka, one of these with ammoniac, assafetida, carbonate of ammonia, &c.; and, in mixed cases, the three sets may all be given together.

During the use of expectorants, the skin should be kept warm; as coldness to the surface, checking perspiration, has an analogous effect sympathetically upon the bronchial secretion. The patient should be clothed in flannel, or other woollen fabric next the skin, and, in acute cases, and in cool weather, should be confined within doors, if not in bed.

The expectorants may be arranged in the two divisions of the nauseating or depressing, and the stimulant.

1. *Nauseating or Depressing Expectorants.*

All emetic substances, with nauseating properties, may be employed as expectorants. I shall content myself with considering specially *ipecacuanha* and *tartar emetic*. *Lobelia* and *sanguinaria* are used for the same purposes by some American practitioners; but all that is necessary has been already said of them in the class of emetics. *Squill* and *seneka* might, by their nauseating properties, when given in large doses, be ranked in the same category; but their locally stimulant properties are so considerable as to more than counterbalance the nauseating, as they are ordinarily administered; and they will be best considered in the stimulant division.

I. IPECACUANHA. *U. S., Lond., Ed., Dub.*

Ipecacuanha has already been treated of among the emetics and diaphoretics (ii. 483 and 636). In nauseating doses, it acts, like other nauseants, in promoting expectoration in an excited state of the pulmonary circulation. Even in quantities insufficient to produce the sensation of nausea, it probably exerts a less degree of the same relaxing influence through the nervous centres. But there is reason to think that, through the absorption of its active principle, it operates also directly on the secretory function. By this double influence, it is one of the most certain and energetic expectorants, adapted to the early stage of *inflammatory diseases of*

the air-passages and pulmonary air-cells. It is peculiarly suitable for children, from the comparative mildness of its irritant effect on the alimentary canal; being, on this account, often preferred to the antimonials, where these might otherwise be deemed most appropriate. In *croup* after an emetic, *catarrh*, *measles*, and the *early stage of hooping-cough* occurring in young children, it is much and beneficially used. After expectoration has become fully established, and the activity of the inflammation is passed, the medicine may often be usefully associated with small doses of one of the salts of morphia, or other preparation of opium, to allay cough; and, at an earlier period, the same end may be aimed at by the use of hyoscyamus, or conium, which do not, like opium, restrain the bronchial secretions.

The dose of it for an adult is from half a grain to two grains, repeated every two, three, or four hours, or less frequently, according to the severity of the case, and the degree of its nauseating effect. It should, as a general rule, be kept within the point of decided nausea. But the liquid preparations are much more used as expectorants than the root in powder.

Wine of Ipecacuanha (VINUM IPECACUANHÆ, *U. S.*, *Lond.*, *Ed.*, *Dub.*) is made in the proportion of an ounce of the root to a pint of wine; so that, if the root is exhausted, one fluidounce must contain the strength of thirty grains. From ten to thirty minims may be given as an expectorant to an adult.

Syrup of Ipecacuanha (SYRUPUS IPECACUANHÆ, *U. S.*), according to the U. S. process, is made by preparing a tincture, evaporating this so as to drive off the alcohol, and adding water and sugar to form a syrup. It should have half the strength of the wine, and of course double the dose. From two to twenty minims may be given as an expectorant to children from one to four years old.

Troches or Lozenges of Ipecacuanha (TROCHISCI IPECACUANHÆ, *U. S.*) are made by incorporating the powder with sugar and arrowroot by means of mucilage of tragacanth. The preparation is demulcent and expectorant, and is intended to be held in the mouth, and swallowed as it slowly dissolves. Each lozenge contains about one-quarter of a grain of ipecacuanha. A little of one of the salts of morphia may sometimes be usefully combined with the other ingredients; and the Edinburgh Pharmacopœia directs a preparation of this kind (TROCHISCI MORPHIÆ ET IPECACUANHÆ, *Ed.*), of which each lozenge contains about one-fortieth of a grain of muriate of morphia, and about one thirteenth of a grain of ipecacuanha.

II. TARTRATE OF ANTIMONY AND POTASSA.

ANTIMONII ET POTASSÆ TARTRAS. *U.S.*

Syn. Tartar Emetic.

For a full account of this antimonial, the reader is referred to *page* 57 of this volume. As an expectorant, it is on the whole the most efficient belonging to this subdivision. It operates not only through its sympathetic nauseating influence in relaxing the excited bronchial vessels, but also by a depressing effect upon them, through its influence as an arterial sedative, while it stimulates the secretory cells vigorously by its immediate presence either unchanged, or in a modified state. It thus at the same time reduces the capillary circulation to the secreting point, and promotes directly the secretory function.

As an expectorant, it is employed chiefly in acute inflammation of the air-passages, or pulmonary tissue, whether original or associated with other diseases; but it is occasionally used also, in connexion with the stimulant expectorants, especially squill and seneka, in chronic inflammation of the same parts. It should always be used with great caution, in cases complicated with gastric or intestinal irritation or inflammation, or occurring in a low typhoid state of system. In infants, too, its use requires much care, in consequence of its tendency to irritate the bowels. I have known convulsions repeatedly occasioned in infants by small doses of tartar emetic, in consequence of the violent intestinal spasm induced by it. In all such cases, ipecacuanha should be preferred.

2. *Stimulant Expectorants.*

I. SQUILL.

SCILLA. *U.S., Lond., Ed., Dub.*

For a general account of squill see *page* 581 of this volume, where it is described among the diuretics. Though but slightly stimulant to the system at large, it is decidedly so to any part upon which it specially acts, whether before or after absorption. Its strongest tendency, in the latter condition, is undoubtedly to the kidneys; but, that it has also a decided affinity for the bronchial

mucous membrane, is established, I think, by the fact, that it has so long retained its place, not only in regular but domestic practice, among the best expectorants. It probably not only, like tartar-emetic and ipecacuanha, excites the proper function of secretion in the epithelial cells of the bronchial tubes, but, unlike them, stimulates also the capillary circulation, so as to be unfit for employment as an expectorant in the highest activity of inflammation in these parts. It is true that, if pushed so as to produce its nauseating effect, the relaxing influence of this condition on the bronchial tubes would, in some measure, counteract its direct stimulation; but it would be unsafe to use squill habitually to this extent, in consequence of its irritant operation on the stomach. In the use of this remedy, therefore, as an expectorant, it is always best to wait until the first activity of the inflammation has subsided, or been subdued; and, even then, to conjoin its use with that of tartar emetic or ipecacuanha, especially the former, which, by its depressing influence on the capillary circulation, may counteract the stimulation of the squill.

In the more advanced stage and chronic state of inflammation in the respiratory passages, squill may be given with great propriety; and in those cases, in which a condition of local debility or relaxation has supervened, it may be combined with the expectorants more stimulating than itself.

It is unnecessary to particularize the several diseases in which squill may be administered as an expectorant; as these have already been pointed out in the general observations upon the class.

The *dose* of the powder is one or two grains, which should be repeated every two or three hours in acute cases, three or four times a day in the chronic. But it is seldom used as an expectorant in this form, except in combination with other medicines, in the form of pill, as with ammoniac, in the *Compound Pills of Squill* (PILULÆ SCILLÆ COMPOSITÆ, *U.S.*), which consist of squill mixed with twice its weight of ammoniac and ginger, and made into a pilular mass with soap and a little syrup. From five to twenty grains of the mass, or from one to four of the U. S. pills may be taken at a dose. There are several liquid preparations.

1. *Vinegar of Squill* (ACETUM SCILLÆ, *U.S.*, *Lond.*. *Ed.*, *Dub.*) is made in the proportion of four ounces of squill to two pints of diluted acetic acid or distilled vinegar. This is an excellent solvent of the active matter of squill; and the vinegar is consequently a very efficient preparation. But it does not keep well; and the

syrup or oxymel prepared from it is usually preferred. It may be given in the dose of from ten minims to half a fluidrachm, frequently repeated, and increased, if necessary, until it produce some effect. Should it nauseate, the dose should be diminished.

2. *Syrup of Squill* (SYRUPUS SCILLÆ, *U. S.*, *Ed.*, *Dub.*) is made from the vinegar of squill by the addition of enough sugar to form a syrup. This is the preparation usually employed, when it is desired to obtain the expectorant effect of the medicine. It is peculiarly adapted to infantile cases from its sweet, acidulous, not very unpleasant taste. The dose for an adult is from half a fluidrachm to a fluidrachm; the latter quantity being used when the dose is given at long intervals, as twice a day, for example; the former when it is frequently repeated.

3. *Oxymel of Squill* (OXYMEL SCILLÆ, *U. S.*, *Lond.*) differs from the syrup only in containing honey instead of sugar, and in the circumstance that it is necessary to evaporate it for some time, in order to reduce it to the proper consistence. The use of heat in its preparation is injurious; and, therefore, if the evaporation be not carefully conducted, the preparation may undergo some deterioration in the process. The dose is the same as that of the syrup.

4. *Compound Syrup of Squill* (SYRUPUS SCILLÆ COMPOSITUS, *U. S.*) is a preparation containing seneka and tartar emetic, besides squill, and will be most appropriately treated of under seneka, as the only one of its ingredients not yet noticed. (See *the next article.*)

5. *Tincture of Squill* (TINCTURA SCILLÆ, *U. S.*, *Lond.*, *Ed.*, *Dub.*) is prepared with diluted alcohol, and is of the same strength as the vinegar. It may be used whenever squill is indicated, and the alcoholic ingredient is not forbidden. It is specially adapted to the bronchial diseases of intemperate persons, and all cases attended with general debility, or local debility and relaxation of the parts affected. The dose is from ten to thirty minims, or from twenty to sixty drops.

II. SENEKA.

SENEGA. *U. S.*, *Lond.*, *Ed.*, *Dub.*

Syn. **Seneka Snakeroot.**

Origin. Seneka is the root of *Polygala Senega*, a small, indigenous, herbaceous perennial, from nine inches to a foot in height, growing in woods in different parts of the United States, especially the mid-

dle and southern sections, on both sides of the Alleghany mountains.

Properties. The root is several inches long, tapering, contorted, of about the medium size of a quill, ending at top in an abruptly expanded head, which is rough and irregular from the insertion of the stems of successive years. One of its most striking characters, distinguishing it from all other medicinal roots, is a projecting line or keel, running along its whole length, and having the appearance as if a string were passing from one end to the other, immediately under the bark, shorter than the root, and consequently producing the contorted appearance, which is also characteristic. The colour of the young and fresh roots is yellow, which darkens and becomes grayish by age and exposure. The colour of the powder is grayish. The root consists of an interior wood, and an outer cortical portion, in the latter of which its sensible properties and medicinal virtues reside. The odour is peculiar, but feeble in the dried root; the taste at first sweetish, but afterwards pungent, acrid, and adhesive. When chewed, the root produces irritation of the throat, excites an increased flow of saliva, and sometimes provokes coughing. Its virtues are extracted by water and alcohol, more readily hot than cold. It is injured by long boiling.

Active Principle. The virtues of seneka appear to reside in a peculiar very acrid principle, which, having been ascertained to possess acid properties, has been named *polygalic acid*, though at first denominated *senegin*. It is a white, pulverulent substance, of little taste at first, but after a time extremely acrid and irritant to the mouth and fauces. It is slowly soluble in cold and more rapidly in hot water, very soluble in alcohol, and insoluble in ether and the fixed oils. At a boiling temperature, it is said to combine with one or more principles in the root, to form an insoluble compound.

Effects on the System. Seneka is locally irritant, in large doses emetic and cathartic, and, in its influence on the system, a general stimulant of the secretions, though with a special direction to the lungs and bronchial mucous membrane. It acts occasionally as a diuretic, diaphoretic, sialagogue, and emmenagogue. In over-doses, it produces burning heat in the stomach, abdominal pains, and severe vomiting and purging; and sometimes causes, along with increase of the renal secretion, a sense of heat in the urinary passages. There can be little doubt that its active principle is absorbed, and, carrying its irritant properties into the circulation, excites the capillaries more or less everywhere, but particularly in the different emunc-

tories through which it escapes. *Senegin* or *polygalic acid*, given to a dog, was found by M. Quevenne to cause vomiting with embarrassed respiration, and to prove fatal in large doses. After death, marks of inflammation were found in the stomach, lungs, and trachea, showing a special tendency, after absorption, to the latter organs. Seneka has little observable influence upon the general circulation; and, when given pretty freely, produces so much nausea as, in some degree, to counteract its excitant influence upon the ultimate tissue.

Therapeutic Application. Seneka was first brought into notice in the year 1735, by Dr. Tennant of Virginia, who imagined that it had peculiar virtues in the poison of the rattlesnake, for which it was used by a tribe of Indians. Dr. Tennant also employed it in pectoral diseases. At present no one has any faith in its antidotal powers; but it is among the most highly esteemed expectorants. From its stimulant influence upon the ultimate tissue of the lungs and bronchia, it is not adapted to inflammation of these organs, in its state of highest activity; but in the advanced stages, and in chronic states of the affection, is often very useful. I believe that it does not operate merely by its expectorant properties, but through its excitant and alterative influence on the diseased tissue. It is, therefore, peculiarly adapted to those conditions, in which the bronchial mucous membrane is left enfeebled and relaxed by preceding inflammation, and wants the requisite energy to recover its normal condition. By combination, however, with tartar emetic or ipecacuanha, its irritant influence over the vessels is modified, so that its expectorant effects may be obtained with less risk of over-excitement of the local circulation; and it may thus be given at an earlier stage than it ought to be ventured on alone. Moreover, as before stated, when given very freely, it produces nausea, and thus induces a sympathetic relaxation of the tissues, which may obviate, in a considerable degree, its direct irritation produced through the circulation.

The complaints in which it has been employed most usefully are *pneumonia* in its advanced stages, *bronchitis* after the acute symptoms have subsided, and especially in its chronic states, *laryngitis* under similar circumstances, and *catarrhal croup*. I know no one medicine, except mercury, in which I have greater confidence in chronic bronchitis, whether with profuse or scanty expectoration. It has seemed to me to act favourably in cases of this kind, quite inde-

pendently of any observable influence as an expectorant, and probably by an alterative action on the membrane.

In *croup* it was very highly recommended by Dr. Archer, of Maryland, and, if given so as to vomit freely, will very generally relieve the spasmodic or catarrhal variety of the disease; but it is probably less efficacious than tartar emetic, and not more so than ipecacuanha. To the cure of *pseudomembranous croup* it is quite inadequate; but may nevertheless be used conjointly with other measures, in the hope of producing mucous secretion, and thereby loosening the false membrane. To the condition of tracheal and bronchial inflammation which croup frequently leaves behind, it is admirably adapted, especially in combination with other less stimulant expectorants.

In consequence of its occasional diuretic effect, it is said to have been used with success in *dropsy;* and, in those cases of the disease, not very uncommon, which are associated with chronic bronchitis, it would seem to be indicated, in connexion with more certain diuretic medicines.

It is said to have been useful in *rheumatism*, through its emetic and purgative properties; and its excitant influence on the ultimate tissues places it in the category of alterative medicines, which have been found useful in the chronic forms of that disease, as guaiac, turpentine, &c.

I shall have occasion hereafter to consider the root in relation to its supposed emmenagogue powers.

Administration. The dose of *powdered seneka* is from ten to twenty grains; but it is almost never administered in this state. Decoction, infusion, and syrup are the ordinary forms of exhibition.

1. *Decoction of Seneka* (Decoctum Senegæ, *U. S.*) is made by boiling an ounce of the bruised root in a pint and a half of water to a pint. This may be improved by the addition of an ounce of bruised liquorice root, which tends, by its demulcent properties, in some degree, to cover the acrimony of the seneka. If a grain of tartar emetic be added, the preparation will be rendered still more efficacious in most cases of bronchial disease. A combination of this kind, with the still further addition of an ounce or more of crystallized sugar, was a favourite remedy of the late Dr. Physick in pectoral diseases, and has been much employed by myself in chronic bronchitis. It has, however, been shown that decoction is not the best method of extracting the virtues of seneka, which are impaired by the continued heat. The dose of the officinal decoction

is one or two fluidounces, three or four times a day. The compound decoction referred to, containing tartar emetic, liquorice root, and sugar, besides seneka, may be given in the dose of half a fluidounce or a tablespoonful, every two or three hours.

2. *Infusion of Seneka* (INFUSUM SENEGÆ, *Ed.*) may be made in the same proportions as the decoction, that is, an ounce of the root to a pint of water, and, if duly prepared, is probably more efficient. But, in order that the virtues of the root may be thoroughly extracted, it should be reduced to the state of powder, and then treated upon the plan of percolation. The same additions may be made to this as to the preceding preparation. The dose is the same.

3. *Syrup of Seneka* (SYRUPUS SENEGÆ, *U. S.*) is made by exhausting the root with a mixture of one part by measure of alcohol and three of water, evaporating so as to drive off the alcohol, and then adding sugar to form a syrup. This is an excellent preparation, concentrating the virtues of the medicine in a small bulk, and very convenient of administration. It may be given alone, in the dose of one or two fluidrachms, from two to four times a day.

I am much in the habit, in the advanced stages of catarrhal disease, and in the chronic forms of it, of employing the following mixture, which often answers a very good purpose, in allaying cough, sustaining expectoration, and modifying favourably the condition of the diseased membrane. Take of syrup of seneka and syrup of squill, each, one fluidounce, antimonial wine and solution of sulphate of morphia, each, half a fluidounce, and mix them together. If deemed advisable, ipecacuanha wine may be substituted for the antimonial. One or two fluidrachms may be taken every four, six, or eight hours.

4. *Compound Syrup of Squill* (SYRUPUS SCILLÆ COMPOSITUS, *U.S.*) is an officinal of the U. S. Pharmacopœia, adopted as a substitute for a preparation long extremely popular under the name of *Coxe's hive syrup*, originally prepared by Dr. John Redman Coxe, of Philadelphia. It contains the virtues of squill and seneka, with a grain of tartar emetic in each fluidounce. The chief difference between this and the original preparation is that sugar has been substituted for honey. This syrup has been much used in the treatment of our ordinary catarrhal or spasmodic croup, and will, no doubt, generally prove successful, if pushed to emesis. I do not, however, know that it is in any degree more effectual than the antimonial uncombined. It is a good expectorant, applicable to the somewhat advanced stages of pulmonary, bronchial, and laryngeal inflammation,

whether in children or adults. The dose of it, as an expectorant for an adult, is from thirty minims to a fluidrachm. If given to children with croup, as an emetic, from ten minims to a fluidrachm, according to the age of the child, should be repeated every fifteen or twenty minutes till it vomits.

III. AMMONIAC.

AMMONIACUM. *U. S., Lond., Ed., Dub.*

Origin. Ammoniac is the concrete juice of an umbelliferous plant, denominated *Dorema Ammoniacum*, six or seven feet in height, growing in Persia and Afghanistan. All parts of the plant contain a milky juice. At certain seasons this exudes through punctures made in the stem, and hardens in the shape of tears, which are collected for use. But the drug is said also to be obtained by cutting off the top of the root, in the same manner as assafetida. It is exported from Bushire, and usually reaches Europe and this country through the ports of Hindostan.

Properties. Two varieties of the drug are found in commerce; one in tears, the other in mass. The tears are irregularly globular, from the size of a pin's head to that of a large chestnut, yellowish externally, hard and brittle when cold, and breaking with a smooth, shining, whitish fracture. The masses are irregular in form and size, presenting in their broken surface a mottled appearance, owing to the presence of the whitish tears, imbedded in a substance of a darker colour and less homogeneous texture, and often full of impurities. Sometimes the masses are composed of agglutinated tears, with little or none of the solid pasty matter.

The smell of ammoniac is faint, but peculiar and disagreeable; the taste is bitterish, subacrid, slightly sweetish, and nauseous. When heated, it softens and becomes adhesive, but does not melt. It is inflammable.

Composition. Ammoniac is a gum-resin, consisting essentially of gum and resin, with a little volatile oil, to which it owes its odour. As its virtues reside in the oil and resin, they are extracted by alcohol. Rubbed up with water, the gum-resin forms a white milky emulsion, in which the resin and oil are held in suspension by the dissolved gum.

Medical Properties and Uses. Ammoniac was employed by the ancients. Its properties and applications as a nervous stimulant

and external irritant have been already considered (i. 616). With a very moderate excitant influence over the circulation and nervous system, it has the property of stimulating the secretions, and will occasionally act as an expectorant, diaphoretic, and diuretic, though in none of these respects is its action very decided. It has been said to possess emmenagogue properties, but these are very uncertain. In large doses, it often occasions a feeling of heat, weight, or uneasiness of the stomach, and not unfrequently acts on the bowels.

As an expectorant, it is employed chiefly in chronic cases of bronchitis, in which the secretion is either defective or in excess; and in which it probably operates also as a gentle stimulant and alterative. It has been thought to be specially useful in cases of this kind associated with asthmatic phenomena; and, from its properties as a nervous stimulant, may do good in the obstinate coughs of hysterical patients. In consequence of its locally stimulant and somewhat laxative property, it may be used in cases of habitual constipation, with colicky pains and flatulence, connected with a feeble and torpid or insusceptible state of the alimentary mucous membrane; and, when this condition happens to be associated with a chronic cough, there is a double indication for its use.

Administration. The dose of ammoniac is from ten to thirty grains, to be repeated as other expectorants. It may be given in pill, or emulsion; but the latter form is preferable. It is often administered in conjunction with other expectorants, especially with squill, with which it is combined in the *Compound Pills of Squill* (PILULÆ SCILLÆ COMPOSITÆ) of the Pharmacopœias. (See *page* 656.)

Ammoniac Mixture (MISTURA AMMONIACI, *U.S.*), sometimes called *milk of ammoniac* or *lac ammoniaci*, is made by simply rubbing two drachms of ammoniac with eight fluidounces of water. A tablespoonful is the medium dose.

IV. ASSAFETIDA.

ASSAFŒTIDA. *U.S., Lond., Ed., Dub.*

This has already been fully described under the nervous stimulants (i. 608). Among its important properties is that of stimulating the bronchial secretion, for which it is often and very usefully employed, in chronic pectoral affections, and the advanced stages of the acute. It is admirably adapted to these complaints when associated with nervous exhaustion, spasm, or hysterical disorder. In

the *advanced stage of pneumonia*, when the system begins to sink; in the *same stage of bronchitis, with copious puruloid* or *muco-puruloid expectoration;* in *chronic bronchial inflammation, associated with asthma;* in the second and third stages of *pertussis;* in the declining stage of *phthisis*, with disordered nervous symptoms; in *pure nervous coughs;* in the *pectoral affection of hysterical women*, in the absence of acute inflammatory symptoms, assafetida may be used often with great relief. In the advanced stage of the *pectoral diseases of infants*, it is an excellent remedy.

It not unfrequently happens in the bronchitis and pneumonia of infants, before the close of the disease, that the nervous power appears to be exhausted, and a very alarming condition ensues, which, without caution, may be mistaken for an increase of the inflammation or congestion. There is very frequent and apparently oppressed respiration, the alæ nasi visibly expand and contract, the pulse is very frequent, the child restless, or perhaps approaching a comatose state, and there is obviously great and urgent danger. If, under these circumstances, the hand be applied to the tip of the nose, the ear, or the cheek, they will be found to be cool, instead of hot; and the symptoms are in fact the result of almost complete nervous exhaustion. Assafetida acts here with very great and prompt advantage, and, along with due nutrition, will, I believe, often save the life of the patient, when a perseverance in depleting or reducing measures, would be inevitably fatal.

Sufficient has been said of the dose and administration of assafetida under the former head. I will here merely add that, in the infantile cases above referred to, it may be given to children, under two years, in the dose of one or two grains every hour or two, in the form of mixture or emulsion.

V. GARLIC.

ALLIUM. *U. S., Ed.*

This has already been described in reference to its origin, sensible and chemical properties, and effects and uses as a nervous stimulant in the first volume (*page* 621), and as a diuretic at *page* 625 of the present volume. I wish to call attention here simply to its expectorant properties and applications. In this capacity, it has some resemblance in its operation to squill, though probably less efficient

as a mere expectorant, and more stimulating to the vascular tissue. In another point it approaches very closely to assafetida, possessing like that remedy a decided stimulant influence over the nervous system, which renders it peculiarly applicable to cases of pectoral disease, complicated with nervous debility or exhaustion. It is too stimulant to be employed in acute inflammation of the air-passages, until after all activity of vascular excitement has passed. But at this period, if symptoms of nervous irregularity or weakness should come on, it is an excellent remedy; and particularly in the cases of infants, who are extremely liable to this complication in their acute diseases. I have seen the happiest effects from it under these circumstances, and would strongly recommend it to the young practitioner. The most convenient form for use is that of syrup, made out of the expressed juice with sugar, of which a teaspoonful may be given to a child two years old, and repeated every two or three hours. (See *vol.* i. *p.* 624.)

The ONION has expectorant and nervine properties closely analogous to those of garlic, though inferior, and may be employed under the same circumstances, and in a similar manner.

VI. THE BALSAMS.

Balsams are vegetable juices, liquid, semi-liquid or concrete, which are characterized by containing, along with resin and volatile oil, either the cinnamic or benzoic acid. The balsam of Tolu, that of Peru, styrax, and benzoin, are more or less used, and require brief notices.

I. BALSAM OF TOLU.—BALSAMUM TOLUTANUM. *U. S.*, *Lond.*, *Ed.*, *Dub.*

Origin. This is obtained from *Myrospermum Toluiferum*, a large tree growing in the northern region of South America, especially in the vicinity of Tolu, in New Granada, sixty or seventy miles south of Carthagena. Incisions are made into the bark, through which the juice flows out during the heat of the day. It is imported in tin canisters, earthen jars, or calabashes.

Properties. At first liquid, it soon becomes more consistent, and, as it reaches us, is generally thick, semifluid, tenacious, and of a yellowish-brown colour. By time it concretes into a soft tenacious solid, and ultimately becomes hard and brittle like resin, in which state it is translucent, and of a reddish tint. Its smell is gratefully

fragrant, its taste warm, sweetish, and somewhat pungent. It melts with heat, and is highly inflammable, diffusing an agreeable odour when it burns. It consists of resin, volatile oil, and cinnamic acid, the last of which may be separated by sublimation. It yields its acid, and a minute proportion of its oil to boiling water; but alcohol is its proper solvent.

Medical Properties and Uses. Balsam of Tolu is a gentle topical irritant, and, in its influence on the system, very moderately stimulant to the circulation, with a tendency to act upon the secretory organs, more especially the bronchial mucous membrane. It is also thought to possess tonic properties. Altogether, however, its remedial influences are feeble; and it is employed more as an adjuvant of pectoral medicines, and for its agreeable flavour, than for any very decided curative effect. It is used almost exclusively in chronic bronchial and laryngeal inflammation. The inhalation of the vapour of an ethereal solution of the balsam is said to afford considerable relief, in some old and very obstinate coughs; but it might be difficult to determine how much of the benefit is to be ascribed to the balsam, and how much to the ether, which is itself an excellent alleviating remedy in such affections.

I should not, however, do justice to the subject, without calling attention to the remarks of MM. Trousseau and Pidoux, based chiefly on personal experience, upon the use of the balsams, and especially of that under consideration, in chronic diseases of the air-passages. They state that there are few agents in the Materia Medica so powerful in the treatment of chronic pulmonary catarrhs, and old cases of laryngitis. Without claiming for them the power of preventing or removing tubercles, they consider them as precious means for retarding the progress of tuberculous degeneration, of preserving strength, and prolonging life in phthisis. In bronchial inflammations, they commence with their use earlier than with the more stimulating substances, as the turpentines; so early even as at the end of a week, and in infantile cases still earlier. But it is in the chronic inflammation of the larynx, that they have found most benefit from them, particularly in the ulcerated state, unconnected with tubercles. In this affection, the remedy is applied by means of fumigation, so as to bring the agent into direct contact with the ulcerated surface. The object is best effected by throwing upon burning coals a portion of one of the balsams, that of Tolu preferably, so as to fill the space occupied by the patient, and thus maintain a constant impression by the impregnation of the air he breathes.

They consider this method preferable to the use of the inhaler, as keeping up a more steady influence; but, nevertheless, the latter method may be resorted to, if deemed advisable; the balsam being added to boiling water, and the vapours inhaled. They have found balsamic fumigation useful in chronic catarrhs, as well as in laryngitis.

The same authors speak favourably of the use of the balsams in chronic ulceration of the bowels, such as are left behind by typhoid fever and dysentery. They administer the remedy at the same time by the mouth and by enema, giving, in the latter method, from half a drachm to a drachm of balsam of Tolu, or of storax, "dissolved in boiling water," while the syrup of Tolu is given by the mouth. (*Traité de Thérap.*, &c., 4th ed., ii. 581, 589.)

The *dose* of the balsam is from ten to thirty grains, which may be repeated several times a day. It may be given in pill or emulsion; but the latter form is preferable. The emulsion may be readily made, in the common method, out of the hard and brittle balsam; but, in its ordinary plastic form, there is some difficulty. This may be obviated by dissolving it in the smallest quantity of almond oil, and proceeding with the solution as with castor oil.

Tincture of Tolu (TINCTURA TOLUTANA, *U.S.*, *Lond.*, *Ed.*, *Dub.*) is prepared by dissolving the balsam in officinal alcohol. As a fluidrachm of the tincture contains only five grains of the balsam, the preparation is too stimulant, through the alcohol, for obtaining the full expectorant effects of the medicine, unless in the cases of intemperate individuals, or in very low states of the system. It is, therefore, more used for flavouring cough mixtures, than for any curative effect.

Syrup of Tolu (SYRUPUS TOLUTANUS, *U.S.*, *Lond.*, *Ed.*, *Dub.*) is prepared, according to the directions of the U. S. Pharmacopœia, by adding the tincture of Tolu to sugar, evaporating the alcohol, and adding sufficient water to form a syrup. The London and Dublin Colleges boil the balsam in water, and prepare the syrup from the decoction. However prepared, it is only useful as a flavouring material; as the proportion of balsam is too small to exert any effect on the system. It is, however, much used as a grateful addition to pectoral mixtures.

II. BALSAM OF PERU.—BALSAMUM PERUVIANUM. *U.S.*, *Lond.*, *Ed.*

Origin. The balsam of Peru is obtained from a species of *Myrospermum*, for which the name of *Myrospermum Pereira* has been pro-

posed, in honour of the late Dr. Pereira. This is a large tree, growing in Central America, in the State of San Salvador, on the Pacific coast. The balsam is collected by the aborigines, who make incisions in the bark, and, having burned it slightly to favour the flow of the juice, introduce rags, which imbibe the liquid. When saturated, these are boiled in water, so as to separate the balsam, which on cooling subsides. The supernatant water is poured off, and the balsam, having been purified by straining, is introduced into jars, in which it is exported.

Properties. This balsam is a thickish somewhat viscid liquid, of a dark reddish-brown colour, a fragrant odour analogous to that of balsam of Tolu, yet different and less agreeable, and a warm, bitterish, somewhat pungent taste. It is heavier than water, is inflammable, and consists of resin, a peculiar volatile oil, and an acid, which is either benzoic or cinnamic, but probably the latter. Boiling water extracts the acid, and the oil may be separated by distillation. The balsam is soluble in alcohol.

Medical Properties and Uses. The effects of balsam Peru are essentially the same as those of the balsam of Tolu, last described. It was formerly highly esteemed, and much used, both as a topical excitant, and internally as an expectorant. A notion prevailed that there was in the balsams some property peculiarly favourable to the healing, not only of ulcers, but even of fresh wounds: so that the term balsamic came to be almost synonymous with healing. With this view of its powers, it was very naturally concluded that it might prove serviceable in ulcerative affections of the lungs; and hence it became a popular remedy in phthisis, and other pectoral diseases, presenting analogous exterior characters. At present it is considered useful in indolent ulcers simply as a gentle local excitant, and in chronic bronchial diseases as a mild stimulating expectorant. It is altogether unsuited to acute inflammation of the air-passages, and, indeed, in this country, is used very little in regular medical practice for any purpose.

Among the complaints in which it was formerly used, were also *diseases of the urinary passages*, *leucorrhœa*, *amenorrhœa*, *rheumatism*, and *palsy*. Sydenham found great benefit from this balsam in the pains of colica pictonum, which were frequently relieved by it.

The dose is from half a fluidrachm to a fluidrachm, which may be made into an electuary with sugar, or given more conveniently in the form of emulsion; the balsam being suspended in water by means of gum arabic or the yolk of eggs, and sugar.

III. BEZOIN.—BENZOINUM. *U. S., Lond., Ed., Dub.*

Benzoin is the concrete juice of *Styrax Benzoin*, a stately tree, growing in Java, Sumatra, Borneo, Siam, and other parts of the East Indies. It is obtained by wounding the bark, and collecting the juice as it exudes. This soon hardens on exposure.

There are two prominent varieties of benzoin; one either in separate whitish tears, or masses consisting of aggregated tears with a reddish-brown connecting medium; the other in masses of a brown colour, with few or no tears.

The odour of benzoin is fragrant; its taste very slight, but somewhat acrid after chewing. It is fusible and inflammable, and when melted emits pungent fumes. It consists chiefly of resin and benzoic acid, and, when heated in close vessels, gives out benzoic acid with a fragrant volatile oil. It yields a small proportion of benzoic acid to water, and is wholly soluble in alcohol.

Medical Effects and Uses. Benzoin is moderately stimulant and expectorant; but is almost never used by itself internally. It may be employed advantageously, by way of fumigation, in chronic inflammation of the larynx with ulceration, and in chronic bronchitis; portions of it being thrown upon burning coals so as to impregnate with its vapours the air of the chamber, in which the patient may be placed. The object aimed at should be to keep the air constantly fumigated, but only to such a degree as may be quite comfortable to the patient, without exciting cough. The balsam may also be used by adding it to boiling water, and inhaling the vapour by means of an inhaler. (See *vol.* i. *p.* 77.) There are two preparations of benzoin which are more or less used in medicine.

Compound Tincture of Benzoin (TINCTURA BENZOINI COMPOSITA, *U.S., Lond., Ed.*) is prepared by dissolving benzoin, storax, balsam of Tolu, and aloes in officinal alcohol. The resinous matter of this tincture is separated on the addition of water. It is sometimes used as a stimulant expectorant, and slight laxative, in old pectoral diseases, in doses varying from thirty minims to two fluidrachms; but its chief employment is as a stimulant application to old and indolent, or flabby ulcers.

BENZOIC ACID.—ACIDUM BENZOICUM. *U. S., Lond., Ed., Dub.*

Preparation. Benzoic acid is by all the Pharmacopœias directed to be procured by sublimation. It is the odorous product obtained in this way that is intended, and not the chemically pure benzoic acid, which is inodorous, or that procured from the urine of animals, which, as found in the shops, has an odour, but very unlike that of

the officinal acid. The true officinal substance is procured by sublimation from benzoin. For the method of conducting the process the reader is referred to the U. S. Dispensatory.

Properties and Composition. As officinally prepared, benzoic acid is in beautifully white, soft, feathery, shining crystals, having a highly fragrant odour, arising from a portion of volatile oil that is given over along with it, and a warm, somewhat pungent, acidulous taste. It is fusible by heat, and readily vaporized, sending forth pungent, suffocating fumes. It is also inflammable. Boiling water dissolves a small proportion, which is deposited upon cooling. It is wholly dissolved by alcohol, the fixed oils, and alkaline solutions. The crystallized acid consists of one equivalent of a compound radical called *benzyle*, one of oxygen, and one of water.

Medical Effects and Uses. Benzoic acid is locally irritant, stimulant to the system, and perhaps expectorant. It is upon this probably, or the analogous cinnamic acid, that the balsams depend mainly for their virtues, and especially for the effects they produce by fumigation. But it will be remembered that it is the officinal acid which we are now considering. It is, however, very seldom used internally except as an ingredient of the camphorated tincture of opium, or paregoric, of which it is a constituent.

I have within a few years employed the acid in cases of phosphatic lithiasis, with the object of dissolving the phosphates deposited by the urine, and, in some cases, with striking results, so far as the object aimed at was concerned. Though it is not impossible that the impregnation of the urine, resulting from the use of the acid, may sometimes prove serviceable by a stimulant or alterative influence upon the diseased surfaces, yet it was not with that object that I have prescribed it, as there are other medicines more efficacious. From the experiments of Dr. Garrod and Mr. Keller, it appears that, when benzoic acid is taken internally, the urine becomes impregnated with the soluble hippuric acid, into which it is probable that the benzoic acid is converted. The urine may thus be kept in an acid state whenever desired, and consequently made to hold the phosphates in solution. The acid has also been given for nocturnal incontinence. The dose is from ten to thirty grains, which may be conveniently administered with two parts of borax, or four of phosphate of soda, by which it is rendered soluble in water.

IV. STORAX.—STYRAX. *U. S., Lond., Ed.*

Storax is the juice of *Styrax officinale*, a small tree, indigenous in yria and other parts of the Levant, and naturalized in the South f Europe. It is obtained by making incisions in the trunk, and procured for commerce in Turkey. There are several varieties f it. Sometimes it is obtained in tears, separated or agglutinated; ut these are seldom if ever brought to this country. The varieties ound in our market are two; one in solid friable lumps, consisting f sawdust with more or less of the balsam; the other, called *liquid orax*, a semi-liquid adhesive substance, of a light greenish-gray olour, though nearly black on the surface. It is purified for use y dissolving it in alcohol, and evaporating to the proper consistence.

The odour of storax is fragrant, its taste somewhat pungent and romatic. It is fusible by heat, inflammable, very partially soluble n water, to which it imparts its odour, and quite soluble, with the xception of impurities, in alcohol and ether. It contains resin, a olatile oil, and cinnamic or benzoic acid, with some other ingredients of no practical importance.

Medical Effects and Uses. Storax has the same effects on the ystem as the other balsams, and may be used for the same purposes. It has been occasionally employed in *chronic bronchial affections, complaints of the urinary passages, leucorrhœa, amenorrhœa*, and s a local stimulant application to *ulcers;* but is at present little rescribed, at least in the United States. It is an ingredient in the *ompound tincture of benzoin*, already described (*page* 669), and in the *ompound pills of storax.*

The *Compound Pills of Storax* (PILULA STYRACIS COMPOSITA, *ond.;* PILULÆ STYRACIS, *Ed.*) are made of storax, opium, and affron. The object of the storax is simply to cover the smell and aste of the opium, as its name, in the title of the preparation, conals the important ingredient. Indeed, the object is to afford the eans of prescribing opium, where it may be needed, without the nowledge of the patient; very important sometimes, in order to void leading to evil habits. Five grains of the mass contain a rain of opium.

VII. COPAIBA AND THE TURPENTINES.

I place these together, because, so far as concerns their operation n the air-passages of the lungs, they are almost identical in their

effects. Elsewhere it has been stated that these substances are stimulant to the circulatory system, with a disposition to excite the different emunctories, especially that of the kidneys. They exercise a similar, though comparatively feeble influence on the bronchial mucous membrane. It is probable that all their effects, both local and general, are dependent almost exclusively on their volatile oil, which enters the circulation, and escapes unchanged, or modified, through various outlets, exciting the several tissues in its passage. The lungs afford one of these outlets, and are, therefore, subject to this special influence of the oil. Besides this, they feel, together with all the other vascular tissues of the body, the stimulant action of the oil circulating through them with the blood. There is thus a double action upon the air-passages, which is sometimes available for important therapeutic purposes.

Copaiba and the turpentines may be used in all chronic bronchial and laryngeal inflammations, in which activity of excitement or acuteness of inflammation is wholly past; but especially when there is coincident general debility. They are specially adapted to those old cases of *catarrh* or *bronchitis*, in which there is *copious expectoration of mucous, muco-purulent, or purulent matter*, with general debility, emaciation, night-sweats, &c.; and which bear a close resemblance to pulmonary consumption in their external aspect, though *toto cœlo* different in their real nature.

In all the forms of chronic bronchitis, even without any symptoms of hectic, which have been called *pituitous catarrh*, *bronchorrhœa*, *humoral asthma*, and *tussis senilis*, all characterized by copious expectoration, these medicines may be employed, whenever there is no acuteness in the symptoms to contraindicate them.

They may be used by the stomach or by inhalation.

Copaiba is generally most conveniently given in emulsion, made by suspending it, by means of gum arabic and loaf sugar, in mint water; and may frequently be combined with laudanum, or some other preparation of opium, and with other expectorants, to give it a more decided direction to the lungs. From ten to twenty minims may be administered three or four times a day, or, in cases of urgency, every two or three hours. Or its volatile oil may be substituted in from one-third to one-half the dose.

Turpentine may be used in the same way. The *Canadian turpentine* is the most elegant and agreeable of these oleo-resins; but any one of them may be employed; our common *white turpentine*, *Strasburgh turpentine*, *Venice turpentine*, or the *Chian*. They may be

given also in the form of *pill*, and those having the liquid form in *electuary;* but the emulsion is on the whole the best method, as likely to be most acceptable to the stomach. The *volatile oil* (OLEUM TEREBINTHINÆ) might be substituted; but, from the rapidity of its absorption, it is more stimulant in its operation, and more likely to affect the urinary passages disagreeably. The dose of the turpentines is from a scruple to a drachm.

The following are substances analogous to the turpentines in their effects upon the chest, and are occasionally used for the same purpose.

1. TAR.—PIX LIQUIDA.

This is sometimes, though rarely, administered in substance; either in the form of pill, or of electuary made with sugar. The dose is the same as that of the turpentines. But the form in which tar is almost exclusively used internally is that of infusion, or *tar water*. The mode of preparing this has been already described (ii. 608). It is only necessary here to state that, being less stimulant than copaiba or the turpentines, it may be used in cases which might be thought to have too much acuteness for those medicines, or in which the propriety of using them might be deemed equivocal. From one to two pints may be given daily.

But it is by means of *inhalation* that tar is most useful; and, employed in this way, it is an excellent remedy in pectoral diseases, not only bronchial and laryngeal, but also pulmonary; not only in the chronic, but also in the acute in their advanced stages, when the expectoration is purulent and somewhat copious, and the system generally enfeebled. In pneumonia, which has advanced to the stage of abscess, in gangrene of the lungs under similar circumstances, in chronic bronchitis and ulcerative laryngitis, it may be used often with great benefit; and even cases of phthisis may be sometimes alleviated. But the remedy must be used long and continuously; for months, and, if necessary, for years. The vapour should never be so concentrated as to irritate or oppress the lungs; but should rather produce an agreeable impression upon them. The remedy is best administered by evaporating tar in a water-bath, so that the heat cannot be pushed so far as to decompose it. This may be conveniently accomplished by means of the nurse-lamp. (See *vol.* i. *p.* 77.) If the patient is confined to the house, the air of the apartment in which he sits or sleeps should

be kept constantly impregnated with the vapour; and, if at home only at nights, he should breathe this medicated air the whole night in his chamber.

2. **CREASOTE.**—CREASOTUM.

Creasote has properties, so far as regards the chest, very similar to those of the turpentines, and may be tried under similar circumstances. The dose is from one to three drops, which may be repeated three or four times a day in ordinary cases, but every two or three hours, when the symptoms are more urgent.

3. **RESIN.**—RESINA.

This is the residue left after the evaporation of the volatile oil from the common white turpentine. When resin is burned, it emits copious visible fumes, which may be breathed with impunity, and sometimes exercise a happy influence in cases of bronchial disease, and suppurating non-tuberculous cavities in the lungs. They are more excitant than the vapours of tar, and adapted only to cases in which the parts affected are in a state of very decided relaxation and debility, without the least suspicion of acuteness in the accompanying inflammation. The resin is employed by being thrown upon red-hot coals (not anthracite) in a shovel, or on the shovel itself heated to redness or nearly so; and the patient is to be in such contiguity as may enable him to inhale the fumes, without being oppressed, or suffering material irritation from them. He should be cautious at first, and gradually increase his exposure, as he finds he can tolerate the remedy without inconvenience.

CLASS VI.

CHOLAGOGUES.

THESE are medicines which increase the flow of bile. In this broadest acceptation of the term, it does not necessarily follow that they increase the secretion; for, as bile collects normally in the gall-bladder, and sometimes, from impediment to its passage, in the biliary ducts, whatever produces an extraordinary amount of pressure on the liver and its appendages, will force it out into the duodenum, whence it may escape by the stomach or rectum, and thus become visible. Such a pressure is exerted in the act of vomiting, especially when severe and protracted; and emetic substances, consequently, not unfrequently act as cholagogues, in this sense of the word. The bile, under these circumstances, does not generally appear in the first discharge from the stomach; because some time must elapse after compression, before it can pass through the ducts, and ascend from the duodenum into the stomach. Hence, tartar emetic is more apt to occasion bilious discharges than ipecacuanha; as, independently of its greater violence, it is more frequently followed by repeated acts of vomiting.

It is not impossible that purgatives, which occasion much straining at stool, may have the same effect of emulging the liver by a mere mechanical action; in which case, also, the bile would appear, not in the first, but in some of the subsequent passages, in more than ordinary proportion.

The appearance, therefore, of bile in the discharged contents of the stomach, or in unusual quantity in the alvine evacuations, must not be considered as a certain evidence of an augmented secretion.

Nor is the absence of coloured bile from the feculent discharges a positive proof of suspended or diminished secretion of the liver. Leaving out of consideration those comparatively rare cases, in which mechanical obstruction is offered to the escape of the bile into the duodenum, as by the presence of biliary calculi in the tubes, and in which there is of course, without a necessary diminution of secretion, an absence of bile from the evacuations, there may be others, in which no obstruction exists, and in which, never-

theless, there may be the same want of colour, with an undiminished amount of secretion. When bile is chemically examined, it is found to be a complex fluid, of which the colouring matter is only one of the ingredients. The colour, therefore, like that of the blood, is not inherent in the whole fluid, but only in a particular principle contained in it. This colouring principle, however, is so generally found in bile, that it may be considered as a characteristic ingredient, as urea is of the urine; but, as urea may be morbidly wanting in the urine, so may this colouring matter also be in bile. Therefore, the absence of it in the alvine evacuations is not a positive proof of suspended action of the liver; but only that the organ does not secrete the yellow matter. It follows, too, that medicines may increase the biliary secretion, without any evidence of that increase being presented in the stools. They may increase the non-coloured ingredients, without the coloured; as diuretics may greatly augment the flow of urine, without any increase of urea. Unhappily, however, we have no means of deciding, in any particular case, whether there is or is not an increase of biliary matter, if unattended with the colouring principle, unless by an elaborate chemical examination, which few practitioners will be disposed to undertake. We cannot, therefore, determine, except conjecturally, in relation to any particular medicine, whether it is cholagogue or not, when the evacuations are either of the natural colour, or deficient in colouring matter.

It is an opinion which I advanced nearly thirty years since, that the colouring matter of bile is not a *product* of secretion, but merely separated by the liver from the blood, in which it exists normally, as a result of the disintegration of the tissues, or more probably of the blood-corpuscles. In this view of its origin, it may be increased or decreased in the bile, without a necessary alteration in the proportion of the other constituents. But, as its augmentation is the only certain evidence we have of an increase of the hepatic secretory function, and consequently the only proof of the excitant influence of any medicine on that function, we can consider as cholagogue, so far as the act of secretion is concerned, only those substances which give this proof of their operation.

We may admit, therefore, two modes of obvious cholagogue action; one by mechanical pressure, forcing out the accumulated bile; the other by an increased secretion, so far as it can be measured by an increased elimination of the bilious colouring matter. In reference to the first method, it may be left out of

consideration here, as having only an incidental relation to the subject; the special object being at present the consideration of influences affecting the function of the liver. But there is one mode, in which this mechanical result may be produced through an increase of the secretory function. The bile is sometimes so thick and viscid that it will not flow readily through the ducts. If now the liver can be made to throw out thin liquid, with or without colouring matter, the thick bile may be diluted, and the tubes washed out as it were, thus giving to the evacuations a highly bilious appearance, although there may have been no increased production of the colouring matter. It is very probable that many of the general secretory stimulants may have this effect in emulging the liver, and thus seem occasionally to increase the ordinary quantity of bile evacuated. Many substances, supposed at various times to have a special influence on the liver, may have acquired their reputation in this way; but, not producing obvious bilious evacuations under ordinary circumstances, and as a general result, have not sustained this reputation.

In former times, during the prevalence of the absurd doctrine of signatures, a notion prevailed, that yellow substances were specially efficient in increasing the flow of bile; and hence rhubarb, turmeric, the yolk of eggs, &c., acquired some repute as cholagogues. This notion requires at present no refutation.

It follows, from what has been said above, that we are to treat here as cholagogues only substances which are known to increase the secretion of bile, as measured by the augmented quantity of the coloured liquid evacuated, or by the deepened intensity of the colour. Some may be disposed to doubt the possession of this specific property by any medicine; and the number of medicines is certainly not great which are known to possess it; but, when it is considered that the administration of certain substances is uniformly, or almost uniformly, followed by bilious stools, no matter what may be the state of the system, whether in health or disease, and that this effect may be repeated as often as the dose of the medicine is repeated, showing that it is not dependent on the mere evacuation of the reserved bile of the gall-bladder, we cannot reasonably deny the existence of such a class.

Like all other organs, the liver may be irritated to a point at which its function is diminished or suspended. If, in this condition of the organ, medicines are administered which abate, with-

out entirely removing the excitement, it may be reduced to that degree at which function is promoted, and the secretion of bile may thus be increased. Hence, when the liver is actively congested, and the biliary function checked, the administration of emetic substances in nauseating doses, or of arterial sedatives, may, on the principle referred to, prove cholagogue. Thus, antimonials promote the hepatic secretion, when it is restrained by high vascular irritation or active congestion, as in bilious fevers, and the early stage of hepatic inflammation. Warm baths have the same effect by their relaxing operation.

Any excitant influence upon the portal circulation in the liver, which moderately increases it, may stimulate the secretory function, and produce an increased flow of bile. One of the influences of this kind is *mechanical agitation of the liver*, such, for example, as is experienced in *horseback riding*, and exercise in a jolting carriage, both of which act as cholagogue agents in a torpid or inert state of the organ; but are, on the contrary, injurious, when the function is inoperative in consequence of an overwhelming active congestion.

Of a similar nature is the operation of *emetics* on the hepatic function. I do not here allude to the emulgent effect produced by their pressure. This has been noticed above. But the agitation of this very pressure, excites the function, and thus often positively increases the secretion of bile. Hence the use of emetics in jaundice, dependent on the suspension of this secretion. An antimonial emetic is among the most effectual remedies in that disease.

Heat, too, is a powerful excitant of the hepatic function. There is an obvious reason why this should be so. When the system is heated above the normal standard, there is less of its superfluous carbon thrown off by the lungs in the shape of carbonic acid, because the heat generated by the oxidation of the carbon is not wanted. This element, therefore, which is noxious in excess, must seek some other outlet, by which it may escape, without undergoing this kind of combustion in the body. Such an outlet it finds through the liver, by which it is thrown off in the shape of fatty matter or cholesterin; and, to accomplish this depuration, nature has established such a relation between heat and the liver, that the former is a powerful stimulant to the secretory function of the latter. The excitation produced by heat is often carried to excess; and hence the bilious diarrhœa, and the cholera morbus or vomiting

and purging of bile, so common in hot weather. Not unfrequently the stimulation passes the secreting point, producing high vascular congestion or inflammation. Often, moreover, a steady continuance of the influence at the point of increased secretion, ends, after a time, in wearing out the excitability of the organ, and a torpid or inert condition of the function results. It is only, therefore, by a moderate and intermittent action that heat proves cholagogue. Though more powerful as a cause of disorder in this way, than efficient as a remedy, it may nevertheless be used with advantage in stimulating the torpid liver, when the torpidity does not depend upon a previous pathological influence of heat itself. A *hot bath* may be used advantageously for this purpose. I have already stated that the *warm bath* may act as a cholagogue, by producing relaxation, or an opposite state of the organ, when the function is suppressed by over-excitement of the liver.

Another method by which the secretion of bile is promoted is by the contact of *irritant substances* with the mucous coat of the duodenum. Reference has been already made, more than once, to the sympathetic relation existing between a secreting gland and the surface of the cavity into which its outlet opens, as, for example, between the salivary glands and the inside of the mouth. Just as irritants, applied to the buccal mucous membrane, excite a flow of saliva, so may irritants of almost any kind, remaining for a sufficient length of time in contact with the inner surface of the duodenum, produce a flow of bile; and hence numerous bodies may occasionally prove cholagogue, without any special influence over the function. Such, probably, are most of the drastic cathartics.

In relation to the special cholagogue medicines, I have already treated of all which are known to belong to the class. It will be sufficient here simply to mention them, and to refer to the observations elsewhere made, for a particular account of their mode of action, and therapeutic application in this respect.

The MERCURIALS are beyond all comparison the most powerful cholagogue agents, and are much and very advantageously used in this capacity. (See *vol.* ii. *p.* 247.) Of these calomel and the mercurial pill are most used; the former being much the more effective of the two. As stated on a former occasion, the mercurials are much more efficient in this way when swallowed, than when applied externally; because, in the former method, they are absorbed into the portal veins, and distributed immediately to the secretory structure of the liver, along with the materials out of which the bile is

made; while, by the latter, they reach the organ in much smaller proportion through the hepatic artery, which is probably intended to nourish the liver, rather than afford it matter for secretion.

NITROMURIATIC ACID is probably next to the mercurials, in cholagogue power, of all the medicines which operate by a special influence on the secretory function. The same remark, as to the greater cholagogue efficiency of internal than of external application, may be made of this remedy, as of the mercurials. For an account of its properties and uses see *vol.* i. *p.* 375.

CHLORINE-WATER, and the compounds which chlorine forms with the alkalies, are supposed to have some cholagogue power. (See *vol.* ii. *p.* 356.)

ALOES has, I think, undoubtedly a stimulant influence on this function, of which a strong proof is afforded, in its frequent efficiency in restoring the suspended secretion of bile in jaundice, sometimes even when mercury has failed. (See *vol.* ii. *p.* 500.)

DANDELION or TARAXACUM is supposed to promote the secretion of bile, and to have an alterative influence over the liver, and hence is much used in cases attended with a deficiency of that secretion, and in chronic inflammation of the organ. Though I have employed the medicine very often and freely in these affections, I confess that I feel quite uncertain how much efficiency to ascribe to it; for, having almost always given it with mercury or nitromuriatic acid, I have found it difficult to decide how much of the good effect was ascribable to these medicines, and how much to the dandelion. I am, however, inclined to the opinion, that it has some stimulant influence over the hepatic function.

In relation to the therapeutic uses of the cholagogues, all that is necessary has been already stated, in the remarks made upon mercury in general as an alterative (see ii. 247), and upon calomel as a purgative (ii. 534).

CLASS VII.

EMMENAGOGUES.

THESE are medicines which have the special property of promoting the menstrual discharge. Difference of opinion has existed in regard to the nature of this evacuation, whether it is to be considered as a secretion or hemorrhage. That it is not the result of secretion, in the sense in which some modern physiologists regard this function, as performed, namely, through the agency of cells, is very obvious; for, examined by the microscope, it is found to contain the red corpuscles of the blood unchanged, and these could hardly have entered into the interior of a cell with a perfect integrity of their envelope.

But, though not a secretion, in this sense of the term, it cannot, I think, be considered as a simple hemorrhage. The liquid eliminated differs from blood in some material points, the most prominent of which is its want of coagulability. It is urged, in reply to this objection, that the property of coagulation is lost in consequence of the slowness with which the blood oozes out from the vessels, and of its intimate mixture with the mucus. But the menstrual fluid often escapes in considerable quantities, still characterized by its want of coagulability; and it is only when the normal discharge is replaced by a true hemorrhage, that the fibrin exhibits its coagulating property. There are generally also differences in colour and odour, which indicate an absence of perfect identity with blood. Besides, the discharge is frequently preceded and followed by the escape of a whitish or colourless liquid; and there seems a gradual passage from one of these kinds of discharge to the other; and sometimes, indeed, an intermediate condition between the two. The menstrual fluid, therefore, differs from pure blood. It is undoubtedly separated from the circulating mass, and probably undergoes some modification in the act of separation. The term secretion, in its widest sense, might apply to a liquid of this kind. The menses, therefore, in this view of the subject, may be looked on as a secretion.

That it is not a mere hemorrhage would seem also to be inferrible from the following considerations; that it occurs at a regular

period, and in obedience to certain fixed laws; that it has an important influence upon conception; that, from its regular periodicity, it is probably under the control of the organic nervous centres; and that it does not depend, as hemorrhage generally does, either on a simple general or local plethora, a morbid state of the blood, or a relaxed and debilitated state of the vessels. The system may be in every stage of plethora, from the lowest to the highest, and the uterus in every grade of active congestion up to inflammation, and yet the menstrual flux shall not occur, except at the appointed time. It can scarcely be doubted that, under the special laws governing the female economy, and operating probably through the organic nervous centres, the vessels of the uterus assume at certain periods a special condition, in which a certain amount of blood is thrown off, somewhat modified in its obvious characters, and with an important purpose. It is then, strictly speaking, a special function that is performed, in the act of menstruation.

Some deny that there are any emmenagogues, that is, medicines calculated to promote menstruation by a special influence. But why should there not be such medicines? The process has been shown to be an important and peculiar function; and what is there in it, so different from other functions, that it cannot have its special stimulants? From analogy we should rationally infer that it would probably have such stimulants; and the question is then one of mere experience and observation, whether it has or not. Now assuredly there are medicines, under the influence of which the menses, long suppressed, are very frequently restored, and when existing are increased; and some have been found to have much greater influence than others, independently of any difference in mere stimulant power over the uterine circulation. That they operate less uniformly than some other secretory stimulants, and often fail to act at all, probably depends on the fact, that, in order to the performance of the function, there must be a special state of the uterus induced, and this can be induced normally only at particular periods. Unless in this condition of the womb, emmenagogues cannot act as such. They may produce local plethora of the organ and consequent hemorrhage, but they cannot bring on the proper menstrual flux. They may, however, aid nature in inducing the peculiar condition referred to, and, when it exists, may bring on the exercise of the function to which nature herself may be inadequate.

Except in its periodicity, menstruation obeys the same general

laws with the other secretory functions, and the influences which promote it operate upon the same general principles.

Not unfrequently the function is suppressed in consequence of a vascular irritation or active congestion of the womb, with or without general plethora and excitement, in obedience to the general law, that a certain excess of excitement in an organ diminishes or suspends its function. Under these circumstances, whatever diminishes the excitement down to the point at which it is calculated to increase function, may bring on the discharge; and bleeding, the saline catharties, the antimonials and other refrigerants, the free use of warm diluent liquids, the warm bath, &c., may act as emmenagogues, if not carried so far, as to substitute a state of depression for that of excitation previously existing.

Again, like all other functions, menstruation is defective or suppressed through a want of sufficient energy, either of the uterus itself, or the nervous centres which govern it. The organ is in a state of torpor, inertness, or debility. This condition may be entirely local; in which case medicines calculated specially to stimulate the uterus itself, or its nervous centres, operate as emmenagogues. Or it may depend on a debilitated state of the system generally, and especially upon an impoverished condition of the blood, in which that fluid is incapable of affording the necessary healthy stimulus to the function. In such a case, it is obvious that the remedies, calculated to bring about a return of the function, are those which are fitted to give energy to the system at large; as tonics, a nutritious diet, and, in the anemic state of the blood, the chalybeates especially.

When, so far as can be discovered, there is no excitation or depression of the system or the organ, and yet the function is insufficiently performed, or not at all, the application of a gentle stimulation to the uterus, without anything specific in its character, will often induce a return of the menses. *Purges* which irritate the lower portion of the bowels, and *stimulating diuretics* which produce the same effect on the urinary passages, may act on the uterus and its appendages by a kind of contiguous sympathy, and thus stimulate its function. *Stimulating injections* into the *vagina*, as, for example, of solution of ammonia sufficiently diluted, will have the same effect. The hot *hip-bath* operates in a similar manner. But perhaps no direct excitant agency is equal to that of *electricity*, which has frequently a powerful effect in restoring the menses. (See i. 548.) Active and

vigorous exercise often has the same effect. Even a fixed attention of the mind upon the function will sometimes, it is asserted, bring it into operation. (See *vol.* i. *p.* 548.)

The proper or special emmenagogues probably operate by absorption into the circulation, and a direct action on the uterus, the ovaries, or the nervous centres, or all three together, so as to induce the menstrual tendency, at the same time that they directly excite the uterine vessels.

Whatever may be the methods employed, they are most effectual when brought to bear upon the system at the regular period for the menstrual effort, at which time very slight causes are often sufficient to bring on the discharge. When pain, or a sense of weight in the loins, flushed face, headache, and various abnormal sensations, give evidence that the period is present, it will often happen that warm pediluvia, the warm bath, or warm gently stimulating and diaphoretic teas, taken at bedtime, will restore the function.

In considering the several medicines which have claims to be treated as emmenagogue, we find that they may be arranged in three or four subdivisions, based in part upon the possession of other than pure emmenagogue properties. Thus, we have tonics, purgatives, and stimulating diuretics, which appear to possess special influence over this function also; while certain medicines, without particular tendency to other functions, are peculiarly and prominently emmenagogue. Under these divisions, I shall consider the several medicines which seem to me to merit a place in this class.

1. *Tonic Emmenagogues.*

I. IRON.

FERRUM.

The preparations of iron are, I believe, among the most effective emmenagogues. They were employed in this capacity at the earliest period of medical history, and have enjoyed a scarcely interrupted popularity down to the present times. Iron is now universally admitted to be absorbed, and to operate through the blood. One of the most frequent sources of insufficient and suppressed menstruation is an impoverished or anemic condition of the blood; and iron is, beyond all other medicines, most effective in correcting this condition. It thus produces its emmenagogue effect by re-

moving the cause of amenorrhœa. But I am strongly under the impression that it does something more. It certainly often exercises this power, in cases where there is no reason to suspect the existence of anæmia. It is possible that the effect, in this case, may be owing to the enriching of the blood, which thus becomes more stimulant to the function. But why not admit that iron is one of the natural healthful excitants of menstruation, operating directly on the organs concerned, whether the nervous centres, the ovaries, or the uterus, and sustaining them in a condition best fitted for the performance of the office assigned? I can see no difficulty in admitting this claim on the part of the chalybeates, and consequently in ranking them among the special emmenagogues.

They are contraindicated only in plethoric states of the system, and in active congestion of the generative organs.

Any one of the preparations may be used which is capable of producing the general effects of the chalybeates on the system; but the *powder of iron* (FERRI PULVIS, *U. S.*), or the *pills of carbonate of iron* (PILULÆ FERRI CARBONATIS, *U. S.*), commonly called *Vallet's ferruginous pills*, are those which, on the whole, are probably most efficient. But upon the choice of the ferruginous preparations, as well as in reference to their dose, and mode of exhibition, the reader is referred to the general subject of iron (*vol.* i. *p.* 441).

Iron is very often given in combination with other emmenagogues, especially with aloes and myrrh, which are conjointly indicated in very many cases. It should be given in moderate doses, three times daily, and steadily continued, either till the desired effect is produced, or until the system becomes so plethoric as to offer a contraindication to its further use.

II. MYRRH.

MYRRHA. *U. S., Lond., Ed., Dub.*

Myrrh has been fully described among the tonics. (See *vol.* i. *p.* 303.) Though I confess that I cannot bear a strong personal testimony to the emmenagogue properties of this medicine; yet the general medical opinion, which has so long maintained it among the standard remedies in amenorrhœa, can scarcely have been quite mistaken. It is used under circumstances similar to those which call for the chalybeates, and is very often associated with them; but is

more especially adapted to cases in which amenorrhœa is conjoined with chronic pectoral disease. For its dose and modes of administration, I must content myself with referring to former articles on the subject. (See *as above*, i. 303.) It is almost always given in combination with other medicines, and forms an ingredient in a considerable number of officinal preparations, used with a view, partly at least, to the emmenagogue effect. See *Compound Decoction of Aloes* (ii. 503); *Compound Mixture of Iron* (i. 453); *Pills of Aloes and Myrrh* (ii. 502); *Compound Pills of Iron* (i. 453); and *Compound Galbanum Pills* (i. 615).

III. TANSY.

TANACETUM. *U. S.*

This is much more employed in domestic than in regular medical practice. The extent to which it has been long used, and continues to be used in families, with a view to its effects upon the uterine function, especially among country people, proves, I think, that it is not without powers of this kind; and I have been assured, upon good medical authority, that it is not only an excellent emmenagogue, but possessed of considerable powers in promoting uterine contraction. The *volatile oil* has been frequently used with a view to produce abortion; and reference has already been made to three cases of death, caused by it in this country. (See *vol.* i. *p.* 311.) As an emmenagogue, it is best employed in the form of infusion (*Ibid.*) and should be exhibited most freely at the period when the menses ought to appear in their due course.

2. *Purgative Emmenagogues.*

Most of the drastic purgatives sometimes prove emmenagogue, through the irritation of the lower bowels, extended probably by sympathy to the uterine system. But there are two cathartics to which this property is supposed specially to belong, and which, therefore, deserve particular notice here.

I. ALOES.

ALOE. *U. S.*

For a particular account of aloes as a purgative, see *volume* ii., *page* 495. That this medicine has a powerful influence in promoting menstruation, we have sufficient proof in the united testimony of ages, and its almost universal employment for the purpose at the present time, both in regular and irregular practice. Of the numerous compounds used in the treatment of amenorrhœa, aloes is generally one, if not the most prominent of the ingredients. It is supposed by some to act simply as a purgative, through its irritant influence on the lower bowels. I have myself no doubt that its operation on the uterus is as direct as upon the colon and rectum. There is good reason to believe that it operates on both parts through the circulation. Absorbed into the blood, and circulating through the system, it affects especially those parts which are peculiarly susceptible to its influence; and the uterine system bears, in this respect, the same relation to it as the mucous membrane of the alimentary canal. A strong proof of this is, that it often appears to act as an emmenagogue, without any purgation, or observable irritation of the bowels. It is, however, peculiarly applicable to cases in which amenorrhœa is accompanied with constipation. As it is both locally and generally somewhat stimulant, it should not be used in plethoric conditions of the system, or active congestion of the uterus; but may be given in all other cases of amenorrhœa.

There are two modes of exhibiting it, one in full purgative doses, the other in small doses frequently repeated. When the menstrual period is at hand, it will probably prove most efficient if given in the former method, so as to operate energetically on the bowels; in the dose, for example, of from ten to twenty grains. Thus given, it sometimes brings on an immediate flow of the menses. But, in general, it is best administered in small and repeated doses, so as to operate not more than once or twice daily, and to sustain a moderate but prolonged effect upon the pelvic viscera. It may be used in this manner for months, if necessary, being suspended if found to produce great irritation of the rectum. The dose, for this purpose, is from one to three grains, which may be repeated twice or three times daily. It is most frequently given in combination with iron or myrrh, or with the two jointly. For an account of the forms in which it is exhibited, see *page* 502. The

following are the officinal combinations given with a view to the emmenagogue effect:—*Compound Decoction of Aloes* (ii. 503); *Pills of Aloes and Iron* (ii. 502); *Pills of Aloes and Myrrh*, or *Rufus's pills* (ii. 502); *Compound Pills of Rhubarb* (ii. 491); *Powder of Aloes and Canella*, or *hiera picra* (ii. 503); *Tincture of Aloes and Myrrh*, or the old *elixir proprietatis* (ii. 503); and *Tincture of Rhubarb and Aloes*, the old *elixir sacrum* or *sacred elixir* (ii. 492). The *powder of aloes and canella*, or *hiera picra*, above mentioned, is a good deal used among the lower classes as an emmenagogue. It owes all its properties of this kind to the aloes it contains; as the canella is in but small proportion, and acts only as an aromatic addition.

II. BLACK HELLEBORE.

HELLEBORUS. *U. S., Lond., Ed.*

This, or an analogous species of Helleborus, was employed as an emmenagogue in the earliest times. Among the moderns, its reputation in this capacity is due mainly to Dr. Mead, who strongly recommended it. Since his times, however, much difference of opinion has existed in relation to its powers. Among the skeptics was Dr. Cullen, who states in his *Materia Medica* that, in many trials, he had "never found the emmenagogue virtues of this medicine," nor had he met with any practitioners of his country "who had better success." My own little experience with it coincides with that of Dr. Cullen; but I have ascribed my want of success to the impaired condition of the medicine, as kept in our shops at the time in which I made trial of it. Others, however, give decided testimony in favour of its efficiency. Dr. Chapman speaks favourably of it in his *Elements of Therapeutics* (2d ed., i. 21), considering it "useful, when it purges, in painful menstruation, attended with torpor and constipation of the bowels, and, perhaps, with some degree of insensibility of the uterus itself." Dr. Eberle, on the contrary, states that his own experience has led him to a different conclusion. "It does not appear to me," he says, "that its cathartic effects are, under any circumstances, necessary, or even accessory to the attainment of its emmenagogue results. I have been much in the habit of employing this article in amenorrhœa, and it has always appeared to me that, whenever it purged freely, it was less apt to induce the desired effects." (*Treatise on Mat. Med.*, &c., 4th ed.,

i. 429.) I am disposed to admit that, in moderate doses, twice or three times a day, it will occasionally exhibit, as has been asserted, a tendency to act upon the uterus; though I am also quite convinced that the practitioner who uses the root, or its preparations, as found in this country, in the doses ordinarily prescribed, will very often fail. The preparation most commonly employed as an emmenagogue is the tincture, often called *tinctura Melampodii*, the dose of which is from twenty drops to a fluidrachm, twice or three times a day. If given in a small cupful of infusion of tansy, horehound, rosemary, or other stimulant herb, it would probably prove more effectual than alone. For further information respecting the mode of administering black hellebore, see *page* 553.

3. *Stimulant Diuretic Emmenagogues.*

CANTHARIDES.

CANTHARIS. *U. S.*, *Lond.*, *Ed.*, *Dub.*

In relation to its effects on the system, when internally administered, and its special tendency to the urinary and genital organs, this medicine has already been treated of, among the stimulant diuretics (*vol.* ii. *p.* 619). That it is capable of powerfully stimulating the uterus, along with the other pelvic viscera, there can be no doubt; but it is by no means so certain that it has any special relation to the menstrual function. I should expect nothing further from it than to excite the uterus generally, and thus produce a determination of blood to the organ, which, when there is a deficiency of menstruation from mere torpor or inertness, might produce a return of the function, like any other stimulant. This it is capable of doing, and for this purpose it is considerably employed. It was highly esteemed by the late Professor Dewees as a remedy in leucorrhœa, operating as a stimulant and alterative to the relaxed and debilitated membrane; and it would seem to be peculiarly applicable to cases of amenorrhœa, connected with this condition of the organ. It should never be administered when there is any active congestion, or acute inflammation of the womb, or a febrile state of the system. The tincture is usually preferred as an emmenagogue, being administered in the same doses as for its effects on the urinary organs.

The local application of cantharides, in the form of a blistering plaster to the sacral or pubic region, in amenorrhœa, about the period for the return of the menses, has been recommended, and will sometimes probably prove serviceable.

Of the other stimulating diuretics, the only one used as an emmenagogue is *turpentine* or its *volatile oil.* This has some excitant effect upon the pelvic viscera, and may be used under the same circumstances as cantharides, though less efficient. There is no reason to think that it possesses special emmenagogue properties.

4. *Special Emmenagogues.*

I by no means feel confident that the following medicines all deserve the title here given them. But they have more or less reputation as direct emmenagogues, and some of them are much used, under this view of their powers.

I. SAVINE.

SABINA. *U. S., Lond., Ed., Dub.*

Origin. Savine consists of the tops of *Juniperus Sabina*, an evergreen shrub, from three to fifteen feet high, indigenous in the South of Europe, and, in the character of its foliage, bearing a close resemblance to our common red cedar, or *Juniperus Virginiana*, the leaves of which are often fraudulently substituted for it.

Properties. The terminal branches or tops of the savine plant are closely invested with very small leaves, which are smooth, pointed, dark green, opposite, and so arranged as to form four rows. They have a heavy, peculiar, rather disagreeable odour, and a bitter, warm, and acrid taste. Water and alcohol extract their virtues, but the latter in much the larger proportion. They owe their activity to a volatile oil, which is separated by distillation, and is frequently used instead of the tops themselves.

Effects on the System. Savine is an energetic local irritant, with the property of stimulating the system generally, and especially the uterus. Of its local effects I shall treat hereafter. Taken in moderate and repeated doses, so as not to irritate the stomach, it excites the circulation, increases the temperature of the surface, and appears more or less to stimulate most of the secretions, at

least those of the mucous membranes, skin, kidneys, and liver; though none in a very marked degree. The most decided local tendency is to the uterus. That it has emmenagogue powers is the united opinion of almost all who have given it a fair trial. Though it was not unknown as a medicine to the ancients and earlier moderns, the credit appears to be due to Dr. Home, of Edinburgh, of having satisfactorily determined its properties as a menstrual stimulant. Dr. Cullen says of it, that it has shown a more powerful determination to the uterus than any other plant he had employed. In its higher action, it is accused of producing vomiting, severe abdominal pains, irritation of the rectum with hemorrhoids, general fever, spitting of blood, uterine irritation, and, in the pregnant state, abortion, with dangerous hemorrhage.

In *poisonous doses*, it gives rise to inflammation of the stomach and bowels, and violent constitutional disturbance, which has repeatedly terminated in death. The lowest dose capable of causing fatal effects does not seem to have been ascertained. Orfila killed two dogs with savine, to one of which he gave four, and to the other six drachms of the powdered leaves. From its power of provoking abortion, which it appears to do, not by a specific influence over the contractile property of the uterus, but by excessive irritation and inflammation of the organ, it has frequently been given or taken with criminal intention, and repeatedly with fatal consequences; and it should be generally known, that savine can never be used to produce abortion, with any chance of success, without the hazard of causing death by gastro-intestinal and uterine inflammation, and violent flooding. In a large proportion of the fatal cases, moreover, death has resulted without the occurrence of abortion.

Savine produces its effects on the stomach and bowels probably by contact with the mucous membrane. The effects on the system generally, and upon the uterus, depend on the absorption of the volatile oil.

Therapeutic Application. Savine is one of the most effective emmenagogues, when exhibited in depressed states of the uterus, unattended with general excitement. In the opposite condition of uterine excitement and general fever, it is strongly contraindicated. It has also been given with other objects.

Notwithstanding its emmenagogue properties, it has been employed, with asserted advantage, in *uterine hemorrhage*; and, in cases of this kind, depending on a relaxed and debilitated state of the uterine vessels, it might be expected to prove useful.

Its pervading stimulation renders it beneficial in chronic and obstinate cases of rheumatism, in which it appears to act, like the turpentines, by changing the condition of the ultimate tissue in which the disease is seated.

Hufeland extols savine as extraordinarily efficacious in *chronic gout.* He has succeeded with it after failure with the most powerful remedies.

It is also considered *anthelmintic*, and enters into certain popular vermifuge remedies.

Administration. The dose of the powder is from five to fifteen grains, three or four times a day. It may also be given in infusion, made in the proportion of half an ounce to the pint of boiling water, and given in the dose of a fluidounce.

The *Oil of Savine* (OLEUM SABINÆ, *U. S.*, *Lond.*, *Ed.*, *Dub.*) is officinal. It is colourless or yellowish, has strongly the odour and taste of the leaves, and is lighter than water. The dose is from one to five drops.

II. RUE.

RUTA. *U.S.*, *Lond.*, *Ed.*

Origin. This consists of the leaves of *Ruta graveolens*, or *common rue*, an undershrub, two or three feet high, indigenous in the South of Europe, but now generally cultivated in gardens.

Properties. Rue has a disagreeable odour, which is strongest when it is rubbed or bruised. Its taste is warm, bitter, and acrid. Water and alcohol extract its virtues, which reside chiefly in a *volatile oil*, separable by distillation with water, and sometimes used.

Effects on the System. Rue is locally somewhat acrid, and in its effects on the system, moderately stimulant, with a disposition to act on most of the secretions, and a special affinity for the uterus. It appears also to have some influence on the nervous system, analogous to that of the nervous stimulants. In very large quantities, it acts as an acrid and narcotic poison; producing vomiting, purging, violent abdominal pains, tenesmus, bloody stools, severe strangury, fever, giddiness, confused sight, delirium, involuntary muscular movements, and somnolency, and, with these narcotic symptoms, a small, slow, and feeble pulse, with coolness of the skin, and great debility. These symptoms continue for several days. One instance of fatal result is on record. (See *U.S. Dispensatory.*) The

cases of poisoning have generally followed the use of the medicine, taken with the view of producing abortion, which often occurs. The local effects of rue on the stomach and bowels are probably owing to its direct action on the mucous membrane; those upon the circulation, uterus, urinary organs, and nervous system, to the absorption of its volatile oil.

Therapeutic Application. Rue is often used in domestic practice as an emmenagogue, and with some success. It is especially adapted to cases in which the nervous system is at the same time disordered, as in hysteria with amenorrhœa. It is also used as a nervous stimulant in the colicky affections of children, especially when attended with convulsions. In these cases, it may be administered advantageously by injection. It has been employed as an anthelmintic, and locally as a rubefacient.

The medicine may be given in powder, infusion, or volatile oil. The dose of the powder is from fifteen to thirty grains; of an infusion, made in the proportion of an ounce to the pint, one or two fluidounces; of the volatile oil, from two to five drops.

The remaining substances belonging to this section may, with propriety, from their more doubtful character, be considered in a subordinate position.

I. SENEKA.—SENEGA. *U. S., Lond., Ed., Dub.*

This has been treated of among the expectorants. (See *page* 657.) It is there stated that it is somewhat stimulating to the secretory functions generally. Among other more special tendencies, it has been thought by some to have a peculiar influence in promoting the menstrual function. The late Professor Chapman had considerable confidence in its emmenagogue powers. In his work on *Therapeutics* (2d ed., ii. 7), it is stated that Dr. Joseph Hartshorne, of Philadelphia, was the first to suggest this use of the remedy; and that Dr. Chapman, having derived the idea from him, had used it with such success as to warrant him "in recommending it as one of the most active, certain, and valuable of the emmenagogues." He gave daily four fluidounces of the decoction, in divided doses, and, towards the period when the menstrual effort was expected, increased the dose as far as the stomach would bear it, "having sometimes given as much as two ounces every hour." In the intervals of the menstrual period, he omitted the medicine for a week or two, lest it might become too offensive to the patient. He con-

sidered it peculiarly appropriate to those cases in which a deciduous membrane was formed. The decoction used by him was made by slowly boiling an ounce of the bruised root with a pint of water, till reduced one-third. I have given a somewhat particular account of the plan of Dr. Chapman, in order that, if tried, failure may not take place from inattention to minute, but often important details. I have occasionally employed the remedy, but not with equal success. Its nauseating property, and tendency to disturb the bowels have interfered with its continued use.

II. GUAIAC.—GUAIACI RESINA. *U. S.*—GUAIACUM. *Lond., Ed., Dub.*

This has already been treated of among the alteratives. (See *vol.* ii. *p.* 404.) With its influence on the secretions generally, guaiac was believed, by the late Dr. Dewees, to combine a peculiar influence over the uterus, which rendered it very useful both in amenorrhœa and dysmenorrhœa. He employed it in the form of a tincture, prepared according to a special formula, which will be found in his *Treatise on Diseases of Females* (A. D. 1826, p. 81), and in the *U. S. Dispensatory* (10th ed., p. 1233). The officinal tincture, however, would probably be equally effectual. The dose is a fluidrachm, three times a day, gradually increased if required, and persevered in for a long time. I have used it in some cases, both of amenorrhœa and dysmenorrhœa, and with encouraging success.

Besides the above, several other medicines have had more or less credit as emmenagogues. *Rosemary* (i. 341) and *Pennyroyal*, including, under the latter name, both the PULEGIUM of Europe and our own HEDEOMA (i. 345), have enjoyed some reputation; but they are probably simply stimulant, and act by this property alone, aided by the hot water with which they are usually given in infusion. No doubt, administered in this form, at the period of the expected return of the menses, they will sometimes enable nature to accomplish, what would not have been accomplished without some assistance of the kind. *Assafetida* and the other *fetid gum-resins*, and *garlic* have enjoyed a similar reputation, with perhaps the same degree of merit. *Madder*, or the root of *Rubia tinctorum*, had at one time much credit as an emmenagogue, which, however, it has entirely lost; being now almost universally considered as quite useless in amenorrhœa.

Polygonum punctatum of Elliott (*Polygonum hydropiperoides* of Michaux), the common *water-pepper* or *smart-weed* of this country,

is so highly praised by Dr. Eberle in his work on *Materia Medica and Therapeutics* (4th ed., i. 443) as an emmenagogue, that it cannot be justly passed over without notice. Dr. Eberle says that he has employed it in about twenty cases of amenorrhœa, and declares that "with no other remedy or mode of treatment" had he been so successful as with this. He found it to produce warmth and a peculiar tingling through the system, "slight aching pains in the hips and loins, and a sense of weight and tension within the pelvis," without ever purging or vomiting. He seldom found it necessary to continue the medicine longer than six or seven days. The form used by him was a saturated tincture, of which he gave a fluidrachm three times a day. This is strong commendation; and, if Dr. Eberle's experience should be confirmed by that of others, he will deserve the credit of having introduced a valuable emmenagogue into the Materia Medica.

CLASS VIII.

UTERINE MOTOR-STIMULANTS.

These are medicines which have the special property of promoting uterine contraction. I object to the terms *abortives* (abortiva) and *ecbolics* (ecbolica), implying the power of producing abortion, as suggestive, not of any characteristic physiological property, but of a too frequent misapplication of these medicines.

It is not their characteristic property to cause abortion. Substances which produce that effect may, and often do act, quite independently of any property of directly promoting uterine contraction. Whatever agitates, shocks, or violently irritates the pregnant uterus may occasion miscarriage. The uterine muscles contract, not through the immediate influence of the agent upon the function, but in consequence of some other effect produced by it. Thus, the drastic cathartics, the more energetic of the irritant diuretics, and the stimulant emmenagogues occasionally bring on abortion, either by a sympathy of the womb with a violent impression elsewhere, or through a vascular irritation or inflammation of its membrane or tissue, reacting on the muscular fibres. These abortives are all more or less violent in their action; and their influence, if successful, may always be considered as endangering the life both of the female and the offspring.

Nor do I include in this class those local measures, which, after delivery, assist in promoting the contraction of the womb; such as external friction, irritation applied to the internal surface of the organ, cold, &c.

The medicines now under consideration operate directly upon the muscular function of the organ. They act through the circulation, and may affect the muscular fibres either by direct contact with them, or, what appears to me more probable, through the nervous centres which control their movements.

Their therapeutic applications, in reference specially to their distinguishing property, are not numerous, and will be most conveniently considered under the particular member of the class, which is the most prominent among them. It might be supposed

that their abortive agency would be powerful and effective. But it is not so; for there appears to be some relation between their peculiar property, and the susceptibility of the motor function, which counteracts their influence under circumstances forbidding their use. They cannot at all be depended on, with a view to the expulsion of the fœtus, when yet quite immature.

The individual motor-stimulants of the uterus are very few. Perhaps, indeed, there is only one of which this property is incontestably established. There are others, however, which appear to have some claim to a position in the class, and will receive due attention.

I. ERGOT.

ERGOTA. *U.S., Lond., Ed., Dub.*

Syn. Spurred Rye. Secale Cornutum.

Origin. Ergot is the diseased seed of *Secale cereale* or common rye, irritated into morbid growth by the existence in and about its germ of a microscopic fungus, which is developed along with it, and intermingles its filaments with the substance of the grain. This plant, which was first fully investigated and described by the later Mr. Edwin Quekett, and was named by him *Ergotætia abortifaciens*, consists of a vast number of delicate filaments, interspersed with minute granules or *sporidia*, which envelope the germ, giving it a whitish investment, extending over all its appendages, and imparting to the whole flower an aspect as if mildewed; but, when the grain projects from its coverings, the white coating is not carried with it, and the filaments and sporidia disappear. The ergot occupies the place of the normal seed in the glume or husk, beyond which it projects considerably, often for much the larger portion of its length. Sometimes there are only one or two of these diseased grains in each head of rye, sometimes they are very numerous; but generally the number is from three to twelve. They should be collected a little before harvest.

Properties. The grains are of various size, from one-third of an inch to an inch and a half long, from half a line to four lines in thickness, obscurely three-sided, longitudinally furrowed, tapering from the middle towards each end, and somewhat curved, so as to resemble the spur of a cock, from which they derived the name of *spurred rye* or *secale cornutum.* They are brittle yet somewhat

flexible, of a dark-violet almost black colour externally, but occasionally somewhat glaucous, and internally yellowish-white, or of a light violet colour. They have a smell somewhat resembling, when they are in mass, that of spoiled fish, and a feeble, but disagreeable and slightly acrid taste. Water and alcohol extract their virtues, which are impaired by boiling.

Active Constituents. Many attempts have been made to isolate the active principle of ergot, but with no satisfactory success. A fixed oil, separated from it by ether, was found to possess its virtues, but has been shown not to be, but only to contain the active matter. A principle was discovered by Wiggers, and called by him *ergotin*, which is not without activity, but certainly has not been determined to represent the whole virtues of the medicine. Dr. F. L. Winkler has obtained from ergot a volatile organic alkali, which he has named *secalin*, and which he supposes to exist in the medicine combined with the ergotin of Wiggers. M. Bonjean believes that there are two principles in ergot, one which he calls ergotin, but not the substance to which Wiggers gives that name: the other a fixed oil, in the former of which the medical virtues reside, in the latter the poisonous properties. In this confusion, it is necessary to wait for more light, and, in the mean time, to use the medicine in its well-understood forms.

Preservation. Ergot is liable to be injured by time, especially when exposed to air and moisture. It is also apt to be attacked and destroyed by worms. But, if kept perfectly dry and excluded from the air, it may be preserved long with little change. Camphor is said to protect it against worms. Under ordinary circumstances, it is better kept in the whole state than in powder. The best plan, however, is to collect it every year. There is no doubt that much of the difference of opinion, as to the powers of ergot, is owing to the use of parcels of the drug in different states of preservation.

1. *Effects on the System.*

In moderate medicinal doses, say of fifteen or twenty grains, ergot produces no sensible effects in health, at least upon the male subject. In women, not pregnant, it is said sometimes to cause bearing down pains, dependent on its influence upon the uterus; but, in the pregnant state, it evinces a strong tendency to produce painful contraction of that organ. If the dose be increased to half a drachm or a drachm, it will, in both sexes, occasion some degree of nausea, and more or less cerebral disturbance, attended generally with

some diminution in the frequency and force of the pulse. In still larger doses, of from one to two drachms or more, it evinces decided narcotic properties. With nausea and a disposition to vomit, and sometimes actual vomiting, there are now dilatation of the pupils, giddiness, a feeling as of intoxication, heaviness or pain in the head, and not unfrequently more or less drowsiness or stupor. Sometimes irregular and involuntary muscular contractions have been noticed; but they are not common symptoms. The dilatation of the pupil is an ordinary phenomenon. It is usually, however, moderate, and unattended with disorder of vision. Sometimes the bowels are disturbed, and evidences of gastro-intestinal irritation or inflammation are said to have been presented in some instances; but this is certainly not a necessary or even common result. Sensations of itching, numbness, or fatigue are occasionally felt in the limbs. The circulation is usually depressed, and sometimes greatly so. In female subjects, the uterine contractions are induced much more quickly than the nervous symptoms here described, and do not continue so long. What dose would be sufficient to prove fatal in man has not been ascertained; nor can I find that any instance of death has been traced to a single dose, however large. Quantities varying from two to eight drachms are said to have been taken without very alarming effects. Dr. Wright found three ounces necessary to kill a small dog.

Poisonous Effects. From the long continued use of ergot, in considerable quantities, the most serious consequences have ensued. Fatal epidemics have occasionally prevailed in limited districts in various parts of the Continent of Europe, in Sweden, Germany, Switzerland, and France, which are supposed to have been traced to the use, by the people of these districts, of rye bread, prepared from flour largely mingled with this morbid product. These epidemics have presented very diversified phenomena, some being characterized by symptoms of malignant typhus, others by convulsive affections, and others, again, by gangrene of the limbs. But epidemics of typhous diseases frequently occur, without any connexion whatever with ergot; and others of a convulsive character have been repeatedly described, of which the malignant spinal-meningitis, which has of late years proved so fatal, is a striking example. It is altogether possible, therefore, that the epidemics of these kinds, which have been ascribed to ergot, may have had another origin; especially as no experiments, which have been made

with this substance, would lead to the supposition that it could produce such effects. The same, however, cannot be said of the gangrenous cases.

Dry gangrene seems to have been traced to the habitual use of ergot, without any reasonable possibility of doubt. It has occurred in individual cases, and in communities where ergotted rye has been largely used; and experiments upon the lower animals have satisfactorily shown, that it is one of the regular results of the long continued action of the poison on the system. MM. Trousseau and Pidoux, while refusing credence altogether to the identity of ergotism with the malignant epidemic affections referred to, recognize dry gangrene as one of its characteristic phenomena. They say that, in large districts of France, the peasants have no other food than ergotted rye, that they are quite familiar with this disease of the grain, and that, in sending their crops to the mill, they only separate the largest grains of ergot, allowing the smaller to be ground with the sound grain for their use. A kind of intoxication is produced in those who consume this food largely, which is well known among them, and which, so far from being alarmed by it, they seem to enjoy as that produced by alcoholic drinks. This affection, however, shows itself only in those seasons when the rye is more than usually diseased with ergot. No effects whatever are noticed in other seasons, in which, nevertheless, the same kind of food is used, though not so much contaminated. Yet no epidemic of the kind above referred to has occurred in these districts, even when the diseased grain has been most used. Nevertheless, the use of this kind of food is not without evil results. The peasants, who have long addicted themselves to the sort of intoxication which the strongly ergotted rye produces, fall at length into a condition analogous to that sort of mental decay which characterizes the abuse of alcohol and opium; and occasionally the gangrenous condition occurs, affecting the hands and feet, and sometimes a whole limb. (*Trait. de Thérap.*, &c., 4e ed., i. 723.) The gangrene is preceded by sensations of formication in the limb and over the body, and sometimes by severe pains. In some instances it ceases after attaining a certain point; and the patient, if sufficiently vigorous, may survive with the loss of a portion of his limbs. In other instances it proves fatal, either directly in a few days, or indirectly, after a longer period, through the exhaustion of the sloughing process.

Acute Poisoning. The general symptoms of acute ergotic poisoning, from the use of the contaminated rye, have been described by Dr. Arpi

from personal observation. Usually from half an hour to an hour after a meal, cerebral symptoms begin to appear; such as a feeling of emptiness of the brain, buzzing of the ears, dizziness, muscæ volitantes, dilatation of the pupil, and somnolence. There is no striking delirium, and the patient answers questions, but he does so slowly and with hesitation. Trembling of the upper limbs, weakness of the knees, and an unsteady gait occur, and partial paraplegia in the worst cases. The muscular power is not lost, but only the capacity to regulate the movements, as in alcoholic intoxication. When the patient is placed in bed, profound sleep comes on, with a profuse sweat, and a soft, full, accelerated pulse. Sometimes vomiting and diarrhœa, with abdominal pains, are experienced; in which case, the cerebral symptoms are less severe. The affection continues generally about twelve hours, sometimes however is prolonged as much as two days, and then passes off entirely, with the exception of some dulness of head, such as attends recovery from drunkenness. If the patient take another similar meal, he is similarly acted on; and the affection may become chronic, under the continued application of the cause; but abstinence is followed by restoration to health. (*Arch. Gén.*, Janv. 1855, p. 84.)

2. *Mode of Operation.*

Ergot seems capable of producing local irritation of the stomach and bowels, as indicated by the nausea, vomiting, diarrhœa, and abdominal pains, which have been noticed as among its occasional effects in over-doses. But its characteristic phenomena follow its absorption. These are of two kinds; 1. those dependent on the action upon the uterus, and 2. those upon the brain. It is highly probable that the action on the uterus is produced by an impression on the nervous centres of the organ, and not on the muscular tissue directly; so that the influence of the medicine, after absorption, is mainly if not exclusively on the nervous system. The circulation is said by Dr. Arpi to be somewhat accelerated, and others have made the same statement; but the general current of testimony is in a contrary direction; and, so far as my own observation has gone, I have known the circulation to be depressed, but never, I believe, excited. Nevertheless, it may well happen that an irritant effect on the stomach may sometimes sympathetically excite the heart. But, so far as concerns the direct systemic impression on the male system, it seems to be one of general nervous depression, affecting both the animal and organic functions, and of course involving the heart.

In this way may be explained the tendency of ergotism to terminate in dry gangrene of the extremities. The organic nervous influence, under the continued action of the poison, ceases to be exerted upon the capillaries, which become as it were paralyzed, and unable to carry on the blood. The death of the part follows necessarily. The result is apparently owing to a direct depressing influence of the poison on this part of the circulating system; namely, on the extreme vessels. The gangrene is of the dry kind, because the vessels, in their state of nervous death, can no longer receive and carry on the blood, and consequently collapse. It will be found that, by this mode of operation, we are enabled to explain one of the most valuable therapeutic effects of ergot.

3. *Effects and Use of Ergot as a Motor-stimulant.*

I have hitherto said little on this subject, because it seems to be isolated by its nature, and the remarks upon it come most conveniently under a separate head. Ergot has been long used, in various parts of the Continent of Europe, by midwives, for the purpose of facilitating delivery; but the attention of the profession was first distinctly drawn to the subject by Dr. Stearns, of Saratoga County, New York; and the influence and use of the medicine were familiar to the profession in America, long before it attracted particular notice in Europe. The first published notice of it by Dr. Stearns was in 1807 (*N. Y. Med. Repository*, xi.); an elaborate paper upon its use in promoting labor, arresting hemorrhage, &c., by Dr. Oliver Prescott, was published in 1814 (*Med. and Phys. Journ.*, xxxii. 90); and, according to Dr. Pereira, the medicine was not used in England until 1824.

The effect of ergot in producing painful uterine contraction has been already mentioned. It is most strikingly manifested in the pregnant state, at the normal period of delivery. It comes on, according to Prescott, at periods varying from 8 to 20 minutes after the administration of the medicine; and continues from half an hour to an hour and a half. The contractions differ from the ordinary labour pains in their continuousness; scarcely any interval of repose occurring, until the gradual cessation of the influence of the medicine. The question here presents itself, whether this influence is exerted upon the unimpregnated uterus. Prescott and others have maintained that it is not. But their opinion is contradicted by the positive statements of others, that bearing down pains are sometimes felt in the region of the womb, and rending pains in the

thighs. Another question, of great importance, is whether the medicine is capable of bringing on abortion. Directly opposite statements have been made on this point, both as regards the human subject and the lower animals; but, though we may believe those who maintain the negative of this question, so far as their own observation has extended, yet it is impossible to refuse credence to others who have witnessed the effects referred to. The truth probably is, that the peculiar influence of ergot on the womb is exerted through the nervous centres; and is likely to be most effective, when, in the normal state of the system, these very centres are disposed to the condition in which it is the tendency of the medicine to place them. In this physiological state, they may be supposed to be more susceptible, than under ordinary circumstances, to an impression of the same character as that, which they are prepared to receive from the womb at the full period of gestation. The effect of ergot will, therefore, be much more likely to be felt at this time than at others. But the fact appears to be that, though less apt to excite uterine contraction at other periods, it is capable of producing the effect, in some instances, at any stage of utero-gestation, and even in the unimpregnated state of the uterus. Testimony is too strong to the point, that it is capable of producing abortion, to admit of denial; but it certainly cannot be relied on for the purpose; and would probably fail in the great majority of cases.

The employment of ergot to assist in tedious labours would seem to follow from a knowledge of its powers. Yet opinion is not entirely accordant on this point. Injury both to the mother and child is apprehended. The painful and vehement uterine contractions, with the corresponding efforts of the mother, are thought in various ways to react injuriously upon the system, and, among other results, to endanger rupture of the womb, and congestion of the brain with consequent puerperal convulsions. The death of the fœtus is supposed frequently to result from the violent and unremitting compression, arresting the circulation of the cord, or cutting off the supply of blood by temporarily obliterating the vessels of the uterus itself. Statistics too have been brought fearfully to bear against this use of ergot. There has no doubt been much exaggeration. As the medicine has been most employed in difficult labours, offering some unusual impediment to the ordinary performance of the function, it is very probable that many and much the greater number of fatal results have been mere coincidences, and that they would have occurred without the use of the medicine.

But both reason and experience unite in the conclusion, that ergot may do great mischief; and that an instrument of so much power for evil must be used with caution, and careful discrimination. The rules laid down for its use by the most experienced obstetricians, who advocate a resort to it, are the following. The case must always be beyond the efforts of nature unaided. The os uteri must be dilated, and the outer passages lubricated. The presentation must be natural, or at least not such as in itself to present any obstacle to safe delivery. There must be no mechanical impediment, such as morbid growths, rigidity of the tissues, or disproportion between the size of the head and the outlets through which it must pass. The measure should not be resorted to early, where no serious danger is apprehended from delay; and due patience should be exercised in awaiting the efforts of nature. Dilatation of the os uteri is not insisted on by all; as it has been asserted that the medicine has a tendency to induce this condition. But it is obvious that, should it fail to do so, the greatest danger might be apprehended for the fœtus; and cautious practitioners insist on this prerequisite.

The circumstances which are thought to justify the measure are, 1. lingering labour when the efforts of nature have ceased, or are quite inadequate, and when the above conditions are presented; 2. immediate danger from flooding, with failure of the natural pains, and without malposition of the placenta; 3. when the death of the fœtus is well ascertained, and the patient is in danger from exhaustion or constitutional irritation; 4. when, from previous experience in the case of the individual, there is reason to fear alarming hemorrhage immediately after delivery; 5. retention of the placenta from deficiency of uterine contraction; and 6. dangerous hemorrhage following delivery. But, even under some of the circumstances here mentioned, many practitioners would advise the preferable application of instruments, if they were at hand, and the skill requisite for their use existed. A resort to ergot has been strongly recommended in cases of puerperal convulsions, with a view to hasten delivery; and a number of successful cases have been recorded. Having no experience in these cases, I do not pretend even to offer an opinion; but I can see no danger from the narcotic properties of the drug, which have been urged against its use; for we have no evidence whatever that its influence is irritant or congestive upon the brain; but rather the reverse.

For the expulsion of clots of blood remaining in the uterus, and

of the dead fœtus in protracted cases of abortion, in the earlier stages of pregnancy, there can be no objection to its use.

In reference to the same property of causing contraction of the uterus, ergot is frequently employed, in other conditions than those connected with child-birth. Thus, it has been recommended for the expulsion of hydatids, and for forcing out uterine polypi from the cavity, so as to bring them within reach of an operation for their extraction. Indeed, cases are said to have occurred, in which polypi have been completely expelled by the uterine contraction.

But the most important application of ergot, in cases of unimpregnated uterus, is to the suppression of hemorrhage. It is certainly among the most efficient remedies in this affection. Even the hemorrhage attendant upon cancer of the womb will frequently yield to it. In effecting the suppression, it not unfrequently produces painful contractions of the uterus, showing that this influence is not confined to the state of pregnancy. The suppression is often very prompt, and is probably effected by a contraction of the uterine walls, so as temporarily to close the vessels.

Through the same influence, it may prove useful in *leucorrheal discharges* from the womb. The secretion must be suspended, if the supply of blood is cut off, or materially diminished.

4. *Therapeutic Applications independently of Uterine Contraction.*

The successful use of ergot in hemorrhage from the uterus led to its employment in the same affection of other organs. It has accordingly been used in hæmoptysis, hæmaturia, epistaxis, &c., and in many cases with supposed advantage. In my hands, it has seemed to be very promptly successful in pulmonary hemorrhage; and it is certainly among the hemostatics to which the practitioner may have recourse, with propriety, in almost any case, not connected with an irritated state of the stomach. Even locally, it has been used, with asserted success, for the suppression of hemorrhage. It certainly does not act as an astringent in these cases. An explanation of its operation which appears to me highly probable, is based upon the views of its action on the capillaries already given, in the account of its mode of operation. It appears to me to have a direct sedative influence on the capillary circulation, which, in its greatest extent, is capable of arresting the flow of blood in them altogether, and may consequently end in gangrene. There is, I think, no danger whatever of this result in ordinary medicinal doses; and the remedy may, therefore, be prescribed without hesitation. Though

the direct and speedy suppression of uterine hemorrhage is probably ascribable to the contraction of the organ produced by it; yet the ultimate and lasting cure may be owing to the depressing influence referred to upon the capillary circulation.

The use of ergot has also been extended to many other diseases, in the treatment of which success has been claimed for it by one or another advocate. Thus, it has been used in *gonorrhœa*, *gleet*, and *spermatorrhœa*, with supposed advantage; as also in *diarrhœa* and *dysentery;* and it is not impossible, admitting the influence on the capillary circulation above claimed for it, that it may prove useful in these complaints. In *intermittent fever*, in which it is stated to have proved effectual, its operation on the nervous system would be likely to render it useful; though proofs are yet wanting of its peculiar efficacy. In *hysteria* it may have proved serviceable through the same property. But its applicability to the treatment of *paraplegia*, and *paralytic conditions of the bladder*, for which it has been recommended, would scarcely be inferred from anything that is known of its physiological effects.

5. *Administration.*

For producing uterine contraction, powdered ergot may be given in the dose of twenty grains, repeated every twenty minutes, until the desired effect is produced, or till it occasion unpleasant gastric or cerebral symptoms. It has been customary to limit its use to a drachm; but, in cases of urgency, when its effects are not obtained, the dose may be increased with impunity beyond this amount. As soon as it evinces any influence on the brain, or occasions sickness of stomach, it should be omitted. In the treatment of uterine hemorrhage, and for other purposes, ten or fifteen grains may be administered three or four times a day, or more frequently under urgent circumstances. I have generally used ten grains every two hours during the day, in pulmonary hemorrhage, and have never witnessed ill effects from it. It should not, however, be given continuously for a great length of time. After three or four days, it might be best to suspend its use; to be resumed should circumstances appear to call for it.

An *infusion of ergot* may be made in the proportion of a drachm to four fluidounces of water, of which one-third may be given for a dose, repeated in the same manner as the powder.

Wine of Ergot (VINUM ERGOTÆ, *U. S.*) is made with two ounces of ergot and a pint of wine, and is given in the dose of two or three

fluidrachms to a woman in labour; and one or two drachms for other purposes.

A *Tincture* is directed by the Dublin College (TINCTURA ERGOTÆ, *Dub.*), of which the dose is one or two fluidrachms; and an *Ethereal Tincture* by the London College (TINCTURA ERGOTÆ ÆTHEREA, *Lond.*), made by macerating ergot in ether, and given in the dose of a fluidrachm. But the latter preparation is unnecessary, and is objectionable on account of the extreme volatility of the menstruum.

The *purified extract*, called by M. Bonjean *ergotin*, is sometimes employed. For the mode of its preparation the reader is referred to the U. S. Dispensatory. The dose of it is from five to ten grains.

Though ergot is the only uterine motor-stimulant of undoubted powers, there are several other agents which are asserted to have the same property, and of which a brief notice is requisite.

1. EXTRACT OF HEMP.—EXTRACTUM CANNABIS. *U. S.*—EXTRACTUM CANNABIS INDICÆ. *Dub.*

If the reader will recur to *pages* 782 and 783 of the first volume, he will find that, according to Dr. Alexander Christison, of Edinburgh, the extract of hemp possesses an extraordinary influence over the uterine contractions, bringing them on with great promptness and energy, and having the great advantage over ergot, at least as an aid to parturition, that its operation is not long continuous. It is unnecessary to add anything to what has been already stated in the article referred to. If general experience should confirm that of Dr. Christison, he will have made a very important addition to the resources of the obstetrician.

2. TANSY.—TANACETUM. *U. S.*

This has been already noticed both among the tonics and emmenagogues (i. 310 and ii. 686). Without having any personal knowledge of the powers of tansy, in the relation in which it is here considered, I have been assured by a highly respectable practitioner, in whom I have entire confidence, that, within his own knowledge, the midwives, in his neighbourhood, are in the habit of using an infusion of tansy for the promotion of labour, and with extraordinary success in lingering cases. He has himself also employed the remedy with advantage, and believes it to operate by directly promoting the contraction of the organ, without producing vascular irritation. This is no new application of tansy, but seems

to have been lost sight of by the profession. The oil is often used by the country people with the view of inducing abortion; and three instances of death from it, taken with this object, are noticed in the account of tansy given in the early part of this work. It certainly has a powerful influence on the nervous system.

3. ROOT OF THE COTTON PLANT.—GOSSYPII RADIX.

This is the root of *Gossypium herbaceum*, or the *common cotton plant* of our Southern States. It is said to be much employed by the slaves of the South for producing abortion, and Dr. Bouchelle, of Mississippi, to whom we are indebted for what is known on this subject, considers it not inferior to ergot in its power of promoting uterine contraction. (See *U. S. Dispensatory.*) He believes that it operates without injury to the general health in any way, and uses it habitually to assist lingering labour. He boils four ounces of the inner bark of the root in a quart of water to a pint, and gives a wineglassful every twenty or thirty minutes. Dr. Thomas J. Shaw, of Robertson County, Tenn., confirms the statements of Dr. Bouchelle. (*Nashville Journ. of Med. and Surg.*, July, 1855.) This is a subject well worthy of further investigation. Ainslie states that in India a decoction of the root is used in urinary disorder.

CLASS IX.

SIALAGOGUES.

SIALAGOGUES are medicines which increase the secretion of saliva, and of the mucus of the mouth and fauces. There are two divisions of them; one operating through the system, the other by direct contact with the buccal mucous membrane.

1. There are many substances which more or less increase the secretion of saliva, when taken internally, but very few which do so regularly, or to an amount which would render their employment for this effect desirable. The only medicines which could be relied upon as sialagogues, internally administered, are the preparations of mercury, which appear to exercise a peculiar influence over these glands, though much of their effect must be ascribed to the stomatitis produced by them; inflammation of the mouth operating as a powerful stimulus to the salivary secretion. It is, however, quite unnecessary to pursue our inquiries, in this place, into the sialagogue operation of internal medicines, as none of them are prescribed for their effects in this way, not even the mercurials; and, in relation to the several individual substances having more or less of the property, their possession of it has been alluded to, when they have been elsewhere treated of.

It is a fact, however, of some interest, that the *sensation of nausea* is usually attended with a copious secretion of saliva, and that emetic substances are, consequently, in general, very efficient sialagogues. *Mental influence*, also, has often great effect in stimulating this function. Every one is familiar with the effect of the mere idea of food, especially when the appetite is somewhat keen, in promoting the flow of saliva. The mouth of the hungry man "waters" at the sight or thought of an approaching meal. It is not impossible that such influences may sometimes be brought to bear advantageously upon the function, as a therapeutic measure. Thus, in cases of the monomaniacal, who purpose to starve themselves to death, a plate of food set before them, and allowed to remain, sometimes overcomes an obstinacy which refuses to yield

to solicitation or menaces. In examining the tongue, as an index of the state of the system, if we find the mouth dry, we can often succeed by causing the patient to close his mouth, and move the tongue about, in inducing sufficient secretion to render the parts moist. In such a case, we may infer that the dryness was owing to some comparatively trivial cause; as, in the healthful state, the very thought and effort on the part of the patient provoke the action of the glands; whereas, if the function had been suppressed by some general morbid influence, it would scarcely return upon such gentle solicitation. I have often been enabled to deduce somewhat important practical inferences, as to the state of the system, from this simple experiment.

2. It is only the local sialagogues that are practically employed, and that we are now to consider. These act by an irritant impression on the membrane, which calls the mucous follicles directly into increased action, and the salivary glands indirectly through the sympathy which connects them with the mouth. Any irritant may thus prove sialagogue; and even the act of mastication, though exercised upon a perfectly bland and tasteless object, will have more or less of the effect. As substances used in this way are generally chewed, they are called not unfrequently *masticatories*. Those actually employed remedially are always more or less irritant, and some of them very powerfully so.

They operate therapeutically in three ways; *first*, as direct stimulants to the parts with which they come into contact; *secondly*, by depletion from the secreting vessels; and *thirdly*, by revulsion from neighbouring parts.

1. In reference to the *first method of action*, they may be used advantageously in debilitated or paralytic states of the tongue, fauces, or mouth generally. Loss of *taste* or of *motor power in the tongue*, *relaxation of the uvula* from weakness, and *difficulty of deglutition from palsy of the fauces*, may sometimes be relieved in this way, provided the affection has become quite local, or is not associated with acute disorder of the nervous centres.

2. Through their *depletory influence* they may relieve inflammatory conditions of the neighbouring parts, especially painful rheumatic *inflammation of the jaws and face*, and inflammations not rheumatic of the sockets of the teeth, and of the antra, especially somewhat chronic in their character. Masticatories often prove of considerable service in *inflammatory toothache*.

By *revulsion* they act beneficially in the same affections, as also in

neuralgic conditions of the face, and inflammation of parts somewhat more distant, as in *chronic tumefactions of the salivary glands* themselves, and similar affections of the *Eustachian tube*, the *larynx*, the *eyes*, *ears*, and *nostrils*. In *chronic hoarseness* from inflammation of the larynx, and *deafness* from closure of the Eustachian tube, considerable advantage may sometimes be derived from irritant impressions, made on the fauces by these medicines As the saliva, impregnated with the soluble principles of the masticatory, is swallowed, it has some effect on the stomach also; and this must always be taken into consideration in recommending these medicines.

The substances most frequently used as local sialagogues, are TOBACCO, GINGER ROOT, HORSE-RADISH, MEZEREON, and PELLITORY. These have already been considered, with the exception of the last, which requires a brief notice.

PELLITORY.—PYRETHRUM. *U.S.*, *Lond.*, *Ed.*

This is the root of *Anacyclus Pyrethrum* (*Anthemis Pyrethrum*, Linn.), a small herbaceous perennial plant, growing in the countries bordering on the Mediterranean. The medicine is sometimes called, from its commercial origin, *pellitory of Spain*.

The root is cylindrical, or fusiform, about the size of the little finger, wrinkled longitudinally, light-brown externally with dark shining points on the surface, hard, brittle, with a resinous and radiated fracture, inodorous, and of a taste feeble at first, but afterwards acidulous, saline, and acrid. It produces, also, a tingling burning sensation, which spreads over the mouth and fauces, and is very durable. Its active properties appear to reside in a resinous ingredient.

When chewed, it produces a copious flow of saliva, and has proved useful in *painful affections of the head and face of a rheumatic or neuralgic character*, *toothache*, *palsy of the tongue and fauces*, *relaxation of the uvula*, *&c.* The quantity used at one time may be half a drachm or a drachm. A tincture prepared by macerating a drachm in a fluidounce of alcohol, may be used as a local application in toothache; and the alcoholic extract has sometimes been introduced into the hollow of a carious tooth, for its benumbing effect.

CLASS X.

ERRHINES.

THESE are medicines calculated to produce an increased secretion from the mucous membrane of the nostrils. As all of them are apt to cause sneezing, they are also called *sternutatories*. No medicines are taken internally with this special view. All are applied directly to the interior of the nostrils themselves. So far as the increased secretion is concerned, they operate by directly stimulating the secreting tissue. Sneezing is produced through an impression transmitted to the nervous centres in the encephalon, which then call into action, and combine to one purpose, the various muscles of the chest, neck, and face, concerned in the act. At the same time that the impression is thus made on the nervous centres, which leads to the act of sneezing, a sensation is produced, of greater or less strength, which sometimes serves important therapeutic purposes.

The agencies through which errhines operate beneficially in disease, are 1. a simple stimulant or excitant impression on the Schneiderian membrane; 2. an increased secretion by which they deplete from the vessels; 3. a revulsive influence on neighbouring parts; and 4. the various influences of the sensation excited, and acts produced, through the nervous centres.

1. By their *stimulation of the membrane*, they sometimes prove useful in *defective secretion of the nasal mucus*, or unhealthy dryness of the membrane, in *chronic inflammation of the same*, and in *paralysis of the sense of smell*, and *of the soft palate*.

2. By *depletion* they tend to relieve inflammatory conditions of the neighbouring parts, as of the antra, the frontal sinuses, the Eustachian tube, the ears, eyes, face, and scalp.

3. Their *revulsive* influence is useful in the same inflammatory affections, and also in neuralgia of different parts of the face and scalp. Obstinate *chronic ophthalmia*, *excessive sensibility of the retina*, *amaurosis*, *rheumatic conditions of the eye*, *frontal and facial neuralgia*, *earache*, *chronic otitis* and *deafness*, *obstinate headaches*, and even *chronic*

inflammations of the brain or its meninges, are complaints which offer indications for the use of these medicines.

4. In reference to their excitant impression on the cerebral centres, they are used to *obviate faintness or syncope*, to *restore suspended respiration*, to *compose irregularities of respiration of a purely nervous character*, to produce a shock which may *rouse from insensibility or coma*, when not dependent on active congestion or compression of the brain. By the sneezing they excite, they aid in *expelling foreign bodies* and *accumulated mucus* from the *nasal and respiratory passages*, *rouse sensibility* by their action on the brain, and produce a *shock on the system*, which may aid in the *supersession of paroxysmal affections*, or in *breaking up commencing attacks of disease*. But care must be taken not to employ this measure in cases with active congestion of the brain, or a tendency towards it.

It must be borne in mind, in the use of errhines, that some of them, as tobacco and turpeth mineral, may possibly be absorbed from the mucous membrane, and that they are liable also to be swallowed to a greater or less extent.

Like most other medicines, they suffer a diminution of power by long-continued use.

There are no particular limits to the frequency of their exhibition; the physician being influenced upon this point by various considerations connected with the activity of the medicine, and the particular indication to be fulfilled.

Most substances, whether acrid or not, will act as errhines when snuffed up the nostrils, in the state of powder, if not impalpable; the mucous membrane of these cavities having been made exquisitely sensitive, in order to guard the lungs against the intrusion of noxious agents. Powdered gum or sugar will often produce this effect; and I have known water, a little too hot or a little too cold, to act in a similar manner. But, generally speaking, it is only medicines capable of impressing the nostrils dynamically, that are used for the purpose.

1. AROMATIC POWDERS. Various aromatic herbs, in the form of powder, have been long used as errhines; the choice being directed to them probably by their agreeable odour. *Rosemary*, *sage*, the *mints*, *lavender*, *common* and *sweet marjoram*, *thyme*, or *horehound* may be used, when only a mild impression is desired.

2. **TOBACCO** may be considered as next in the ascending order of efficiency. This is so well known as an errhine, in the different forms of snuff, that it requires no comment here. It is one of the substances to which the nostrils soonest become accustomed; so that to maintain a given impression, for a considerable time, it is necessary to increase the quantity very greatly. In the use of it, the physician should bear in mind its effects on the stomach and nervous system generally, both of which may be produced by this mode of exhibition; and should, also, before prescribing it, give some weight to the consideration, that he may be laying the basis of a habit, which is certainly not very cleanly, to say the least of it, and may be injurious to the health. The effect of snuff in impairing the voice, when much and long used, is notorious; and I have no doubt that its excessive use has the same injurious effects upon the digestive organs, and the nervous system, as smoking and chewing, though probably not in an equal degree.

3. **ASARABACCA** (*Asarum Europæum*) is a small, herbaceous, perennial, European plant, all parts of which possess acrid properties. Both the leaves and root are used. The leaves have long footstalks, are kidney-shaped, somewhat hairy on the surface, nearly inodorous, and of a bitter, nauseous, and acrid taste. The roots are about as thick as a quill, quadrangular, knotted, contorted, of a grayish colour, a somewhat pungent odour, and an acrid taste. Taken internally, asarabacca operates as an emetic, and, before the discovery of ipecacuanha, was considerably used as such; but at present it is employed almost exclusively as an errhine. Snuffed up the nostrils in the state of powder, it excites sneezing, and causes an increased flow of mucus, which is sometimes attended with blood, and is said occasionally to continue for several days. The leaves are milder than the root, and may be used in the quantity of three or four grains. Of the powdered root, only one or two grains should be used. They may be employed every night.

4. **WHITE HELLEBORE** (VERATRUM ALBUM, *U.S.*; VERATRUM, *Lond.*, *Ed.*), which is the root of *Veratrum album*, has been already sufficiently described (ii. 158). The powdered root, when introduced into the nostrils, causes severe and painful irritation, with violent sneezing, and copious discharge of mucus. It is the most powerful of the errhines yet mentioned, and is not without danger, even in this mode of exhibition, if used in excess. Three grains of an extract prepared from it, introduced into the nostrils

of a cat, caused death in less than twenty-four hours. It has been employed as an errhine more especially in cases of *amaurosis*. Before exhibition, it should always be diluted with some mild substance, as powdered gum arabic or powdered liquorice root, of which five parts may be employed to one of the medicine.

5. **EUPHORBIUM** is a concrete resinous exudation of one or more species of *Euphorbia*, growing in the North of Africa. It appears to exude around the thorns or prickles of the plant, where it hardens. It is in the form of irregular or roundish tears, usually about the size of a pea, somewhat friable, with one or two holes produced by the prickles, of a yellowish or slightly reddish colour, nearly inodorous, and of a taste which, though agreeable at first, becomes at length excessively acrid and burning. They are more or less intermingled with dust, produced by their attrition, which excites violent sneezing when drawn into the nostrils. Euphorbium is a severe local irritant, producing inflammation and vesication of the skin when applied, and internally operating as a violent emeto-cathartic. It is supposed also by some to have narcotic powers. It is occasionally used as a rubefacient or vesicatory application, especially in veterinary practice; but it is retained among the officinal medicines chiefly, I presume, as an errhine; though, even in this capacity, it is not much employed. It has been chiefly used in amaurosis and deafness. It should never be applied undiluted, but always mixed with six or eight times its weight of some inert powder, as powdered gum arabic or liquorice root, starch, or flour. Not more than one or two grains should be employed at once.

6. **TURPETH MINERAL** (HYDRARGYRI SULPHAS FLAVUS, *U.S.*) has been already described (ii. 451). We have here to consider it simply as an errhine. In this capacity, it is one of the best of the class. Less powerfully irritant than the last two mentioned, it is more efficient than the others, and may be employed whenever a decided impression is required. It has been chiefly used in *chronic ophthalmia*, and *cephalic affections;* and, as the complaints in which it is most useful are of an inflammatory character, it is not improbable that, in its curative influence, its errhine properties are a good deal aided by its alterative action as a mercurial. It sometimes salivates when applied to the nostrils. One grain may be employed at once, as an errhine, diluted with four or five parts of flour or starch.

CHAPTER II.

Local Remedies Affecting the Organization.

THESE act by inflaming or destroying the part affected. They are all external remedies. Medicines may sometimes cause inflammation, or even gangrene, when taken internally; but they are not given for the purpose. These external remedies are usually arranged in three classes; the rubefacients, epispastics, and escharotics: the first simply reddening, the second vesicating, and the third producing the death of the part. There might also be made a class of pustulating agents; but I have not thought it expedient to multiply subdivisions, and therefore include these among the rubefacients. The distinction between the classes is not absolute. The same medicine may belong to all the three; as in the case of solution of ammonia, which, when feeble, is simply rubefacient, when more concentrated, blisters, and when strongest, acts powerfully as a caustic: and there are few of the more energetic belonging to any one of the classes, which may not be so applied as to produce the characteristic effects of the others. But of the medicines belonging to this division, some are better calculated for one of the modes of action, and others for another; and they are both used and classified according to this preferable applicability. I shall treat first of the epispastics; because their consideration involves, besides what is peculiar to themselves, the principles which govern the others also, so that, in the general observations in reference to the rubefacients and escharotics, it will be requisite to call attention only to a few points of difference; and time will thus be spared.

CLASS I.

EPISPASTICS.

THESE are sometimes called *vesicatories*, and not unfrequently, by an elliptical mode of expression, *blisters*. They are characterized by the special property of blistering; that is of producing an extensive elevation of the cuticle, filled with a serous liquid. Their first effect is to inflame the part to which they are applied; and the subsequent vesication is the result of the inflammation, the distended vessels relieving themselves by effusion. The particular phenomena will be more appropriately detailed under the individual articles of the class. I will here treat only of the general principles upon which they operate as curative agents.

1. Through the sympathy of the system with the inflamed parts, they produce a general excitement, evinced by an increased frequency of pulse, and heat of skin; and, if the surface affected be extensive, they may even induce a general state of fever, in the same manner precisely as fever is generated by internal inflammations, arising from cold or other morbid causes. This symptomatic excitation is greater during the rubefactive stage, than after vesication is fully established; as the emptying of the vessels has the effect of moderating the inflammation, upon which the general phenomena depend. Epispastics are, therefore, primarily local, and secondarily general stimulants.

With a view to their general stimulation, they are used in low states of disease, requiring an excitant influence to support the actions of the heart, and those of the nervous system. It is not on the circulation only that they operate, but also on the nervous centres; and the latter necessarily, before they can affect the former; because it is mainly, if not exclusively through these centres, that the local inflammation influences the heart. The debility of exhaustion is not the condition to which they are most applicable; for, though they excite the nervous centres and heart, they have no stimulant effect on the digestive, blood-making, and nutritive functions, which most need support in this condition of the system. But, when the depression is sudden, arising from some sedative but

temporary influence on the nervous system or circulation, or when, if more protracted, it is sustained by a similar influence more persistent, but still of limited duration, there is an indication for these with other stimulant remedies, in order to arouse the great functions from the torpor in which they may have been left, or to sustain them until the depressing agency shall cease.

A condition of the first kind is presented in the prostration sometimes existing at the commencement of severe fevers, and that produced by a sudden and severe shock, as from a blow on the head, a fall, an overwhelming mental impression, the action of certain violent poisons, &c. In such cases, these external stimulants are often even more applicable than the internal; because, as reaction and high fever or inflammation may follow the state of depression, it is important to employ agents which shall not continue to stimulate after reaction has taken place; and, again, as the head is peculiarly apt to suffer in the reaction, it is advisable to use means least liable to add to the cerebral disorder. These contraindicated effects can be much more certainly guarded against, under the use of external remedies, which may be removed at the moment that they may be no longer wanted, and the general excitement produced by which has no special local direction. Besides, by means of the local impression which may remain after the subsidence of the sympathetic excitement, a revulsive influence is exerted, which, instead of increasing any internal inflammation, would tend to counteract it.

The condition of system, of the second kind above referred to, exists in *low febrile diseases of the typhoid character*, in which the system is depressed by some sedative morbid agency, whether a distinct poison floating in the blood, or a depraved state of the blood itself. It is important in these cases, to seize the proper period for the application of the blister. It should not be employed in the highest state of reactive excitement, nor postponed to the last condition of prostration and debility. In the former it might add injuriously to the fever, in the latter it might endanger sloughing in the blistered part, in consequence of the very low state of its vitality. In doubtful cases of the latter kind, the seat of application, instead of the extremities, where the vital actions are feeblest, should be some part of the chest; or, if it may still be thought proper to apply the blister to one or more of the limbs, the thighs, or arms above the elbows, should be preferred to the leg or forearm, which, under other circumstances, is usually selected.

2. By the general impression or shock made by blisters on the nervous centres, they may be made to *supersede other diseases.* Thus, if applied so as to be in full operation at the period of an expected paroxysm of some regular periodical disease, they will not unfrequently supersede the paroxysm, and thus interrupt, and probably set aside the affection. *Intermittent neuralgia, intermittent fever*, and *both affections also in the regular remittent form*, may often be interrupted in this way. Before the use of quinia in remittent fevers was so well understood as at present, blisters to the extremities were often employed, with the view of breaking the succession of the paroxysms; and they may still be resorted to, with the same object, when circumstances may forbid the use of quinia, as in active cerebral congestion or inflammation, or when that remedy may have failed. It will be remembered that the blister must be in full operation, at the time for the expected paroxysm.

3. Blisters are *powerful revulsive agents*, and are more employed for this effect than any other, or all others combined. The principles on which they act have been sufficiently explained in preceding parts of the work. (See *vol.* i., *p.* 52.) They are, through this mode of action, most important remedies in internal inflammations, and in irritations, whether purely nervous, vascular, or mixed.

a. Of the *nervous irritations* in which they may be usefully employed we have examples in *internal neuralgia*, and *spasm of internal organs*, as of the stomach, bowels, gall-ducts, bronchial tubes, and larynx; and in *disordered internal functions* of almost every kind, dependent on an excitant cause. Special diseases in which this indication may exist are *gastrodynia, simple spasm of the stomach, obstinate vomiting, enteralgia, colic in its different forms*, the *gastro-intestinal spasms of cholera, asthma, pure spasmodic croup, angina pectoris*, internal forms of *nervous gout and rheumatism, obstinate cephalalgia*; and all the diversified disorders of *spinal irritation*, in which the application must be made over the seat of tenderness in the spinal column.

In the course of acute diseases, particularly those of a febrile character, great nervous disorder supervenes, with restlessness, jactitation, universal uneasiness, mental discomposure, want of sleep, &c. These may very often be most happily quieted by a pair of blisters to the arms or legs, which probably operate by concentrating the nervous irritation in the seat of their application, and thus relieving it elsewhere. Under these circumstances, it is no uncommon event for a patient, suffering under obstinate wakeful-

ness, to fall asleep while the blisters are drawing, and to sleep soundly through the whole night.

b. Of the use of blisters in *internal vascular irritations*, we have examples in active congestive affections of the brain, lungs, and abdominal viscera. *Gout* and *rheumatism* often assume these forms. The different *hemorrhages* are other examples. The seat of the blister is often an important consideration in these affections. When the congestion depends exclusively upon a local cause of irritation, or is, to a considerable degree, fixed and constant in the part, it may be best to apply the blister near the seat of the disorder; as to the back of the neck in cerebral congestion and epistaxis, over the lungs in hæmoptysis, over the stomach in hæmatemesis, and over the liver in colic, caused by hepatic congestion. But, where the affection is dependent on a constitutional cause, as of gout or rheumatism, or repelled cutaneous eruption, the blister should be applied either to the legs or forearms, or to that part of the surface, near which the disease may have been seated before retrocession or repulsion. Again, when the affection consists rather in a determination of blood, which may be diverted elsewhere, than in a fixed vascular irritation in the part, the blister should be applied as remotely as possible from the place to which the morbid excitement may be directed. If applied near this part, it will add to the general current of blood in that direction, and might even aggravate the disease. If applied to the extremities, so as to draw the blood and nervous energy to the remotest part of the body, it must lessen the amount proceeding towards the seat of the affection, and does so often in a sufficient degree to effect a cure. Thus, in frequently recurring attacks of cerebral congestion, of epistaxis, of hæmoptysis, &c., in which the symptoms depend rather on some cause occasionally sending excitement into the part, than on disease positively fixed in it, cures may sometimes be effected by blisters to the extremities, which would not happen were the revulsive agent applied near the part affected. The most obstinate case of epistaxis that I have witnessed, which, though frequently arrested, would as often return, and even threatened serious consequences, was in a pregnant woman, and yielded promptly to energetic revulsive applications to the legs, below the knee.

c. In *internal and subcutaneous inflammations*, blisters are of very great importance, and are, indeed, among the standard remedies. These affections are so firmly seated, that revulsive impressions at a distance, though useful, are not sufficiently powerful to exert a

strong influence upon them. To be effective, the blisters must, in these cases, be applied as near the seat of the disease as possible—upon the surface immediately over it whenever practicable. Thus, in inflammation of the cerebral lobes, it should be applied to the scalp; of the base of the brain, to the back of the neck; of the lungs, or pleura, to the chest; of the stomach, to the epigastrium, &c.

Another most important consideration, in relation to the use of blisters in internal inflammations, is the period of the disease at which they ought to be employed. No therapeutic point is better settled than the impropriety of using blisters, in the highest stage of general and local excitement, in acute inflammation. In this condition, they almost always fail to remove the inflammation, while they add their own general excitement to the existing fever, and thus augment the constitutional disturbance, which reacts again injuriously on the local affection. The period for their application is after the subsidence or reduction both of the local and general excitement, when, though the disease is fixed, the blood is less irritant in its character, and its movement through the disordered part less impetuous. A blister at this period will often most happily subdue the residue of an inflammation, which might otherwise advance to suppuration or gangrene, or subside gradually into the chronic form. It should always be preceded by such an amount of depletion, general and local, and of other sedative influence, as the case may seem to call for. As a general rule, the fifth day of an acute inflammation is about the proper period for applying the blister, though certain circumstances may call for an earlier application, or require a longer postponement. Thus, in typhoid inflammations, it may be applied at a much earlier period; and in other cases of great violence and danger, it may be proper to concentrate all the remedies within a shorter time, and thus prepare for an earlier application of the blister by a very energetic use of depletory measures. In chronic inflammations, they may be employed at all stages, and are often very highly useful. In such cases, however, they must, in many instances, be frequently repeated, to be successful. In chronic inflammation of the great joints, particularly of a rheumatic character, they are a most efficient remedy, when frequently repeated; though a single application will be of little use.

4. A third principle upon which blisters act is that of *substitution* or *supersession;* removing the disease by establishing their own action in the part affected, through a more potent influence than

that of the morbid cause. In this way may be explained their operation in *obstinate cutaneous eruptions*, and possibly in *erysipelas*.

5. The *local stimulation* they produce is useful in some cases of *anæsthesia* of the surface and subcutaneous tissue, *local muscular paralysis*, and *threatened gangrene*.

6. Blisters also *deplete*, and, when kept open by stimulating dressings, sometimes do so very considerably, so as to produce a strong local, if not constitutional impression. They are thus useful in inflammation, especially when somewhat superficially situated, as in the *subcutaneous cellular tissue*, the *external absorbent glands*, and *the arteries*, *veins*, and *nervous trunks* of the extremities. In these cases, they act doubly, by revulsion and depletion. Seeming *neuralgia* is not unfrequently traceable to some tender spot in the course of the nervous trunk supplying the part affected; and a blister over this tender spot will often prove highly serviceable.

Upon this principle also, blisters have been recommended in *dropsy;* and sometimes they very rapidly drain off the effused serum. But they are a hazardous remedy, especially if applied to the extremities in a very distended state; as they are apt to induce sloughing, in consequence of the feeble vitality of the part. I have seen an instance of terrible gangrenous ulcers in the extremities, in a case of obstinate dropsy, in which the whole of the effusion was removed, though the patient died exhausted. If ever employed in these cases, they should be applied to the chest and abdomen, and then, not merely to fulfil this indication, but when they may be called for also to relieve some internal inflammation.

7. The *pain of blisters* is sometimes useful in *hypochondriacal affections*, and in the relief of other *nervous disorder*. A medical gentleman once assured me that, while a student, he was excessively troubled by apparently causeless depression of spirits, and that he never was so free from this trouble as when he had a small blister drawing in his epigastrium.

8. Still another purpose for which blisters may be used, is to *obtain a denuded surface*, for the endermic application of medicines.

HEAT AS A VESICATING AGENT.

For this purpose, heat is usually employed in the form of boiling hot water. This has the recommendation of acting with great rapidity. Rubefaction is speedily produced, followed almost immediately by vesication. But the intense pain, the frequent indisposition of the denuded surface to heal, the danger of carrying the effect so far as

to produce gangrene, and the difficulty of precisely limiting the application, are objections which prevent a resort to this measure, except under extraordinary circumstances.

In cases of great and alarming prostration, in which the surface is insensible to the most powerful rubefacients, vesication by boiling water may sometimes be not only justified, but called for. The influence of heat, in torpor and coldness of the surface, seems to restore it in some degree to the normal state of impressibility; and an effect is produced to which no other agent, however stimulating, is adequate. The sudden sinking spells of typhoid or malignant fevers, the prostration amounting to syncope from shocks on the system, the condition approaching apparent death sometimes attendant on intense gastric or other internal spasms, threatened death in angina pectoris when the heart has nearly ceased to beat; these, and other analogous cases sometimes offer the opportunity for the effective application of this remedy. Of course, it is only the first arousing impression that is sought for from it; for the subsequent support of the system, other measures must be depended on.

Boiling hot water may also sometimes be employed to produce a limited vesication for the endermic application of remedies, when it is of great importance that the application should be promptly made, and other vesicating agents capable of speedy action, as the strong solution of ammonia, or one of the stronger mineral acids, may not be at command.

Hot water may be best limited, by applying it carefully, by means of compresses of linen wet with it, or perhaps preferably by a sponge. Its operation should be watched closely, so as to prevent the death of any part of the surface, and a consequent slough.

A plate of metal, heated to 212° by immersion in boiling water, has also been used to produce vesication. (See *Escharotics.*)

I. CANTHARIDES.

CANTHARIS. *U. S., Lond., Ed., Dub.*

Origin. The *Spanish Fly*, or *Cantharis vesicatoria*, is a coleopterous insect, inhabiting the southern and middle portions of Europe, and abundant in Spain, Italy, Sicily, the South of France, and the Southern Provinces of Russia. The insects are collected by beating with poles, or shaking the trees which they frequent, and receiving them, as they fall, in a large cloth spread upon the ground

beneath. They are killed either by exposing them to the vapour of boiling vinegar, water, or other liquid, or by immersing them, contained in bags, in hot vinegar and water. They are then dried, and packed in casks or boxes lined with paper. They are imported from Spain and other parts of the Mediterranean, and directly or indirectly from St. Petersburg. Those from the latter source are larger, and more highly esteemed than the Mediterranean flies, and are distinguished by their coppery hue.

Properties. The insect is about two-thirds of an inch long, and from a sixth to a quarter of an inch in breadth, and is of a beautiful golden-green, or brilliant coppery hue. The powder is of a dark-gray colour, diversified by shining green or copper-coloured particles, which are minute fragments of the wing-cases, head, and feet. Cantharides has a characteristic odour, and an acrid, burning, disagreeable taste, said to resemble that of urine. It yields its virtues to water, alcohol, ether, and officinal acetic acid, especially with the aid of heat. These virtues have been ascertained to reside chiefly, if not exclusively, in a peculiar proximate principle denominated cantharidin.

Cantharidin. This may be obtained by exhausting cantharides with ether, distilling off the ether from the solution thus obtained, dissolving the residue in boiling alcohol, decolorizing with animal charcoal, filtering, and allowing the liquid to cool. Cantharidin is deposited in the form of white, shining, crystalline scales, which are insoluble in water, scarcely soluble in cold alcohol, but readily dissolved by ether, chloroform, the oils at ordinary temperatures, and by hot alcohol and acetic acid, which let most of it fall on cooling. It is melted by heat, and, at a still higher temperature, rises in white vapours, which form acicular crystals upon condensing. It is not injured by any temperature below 300° Fahr. Besides this constituent, cantharides contains a peculiar yellow matter, which has a strong affinity for cantharidin, and through the influence of which, this principle, as it exists in the flies, is rendered soluble in water and cold alcohol, though insoluble in these menstrua, or nearly so, when pure.

Cantharides is apt to be attacked by worms, which, though they do not entirely destroy its virtues, impair them very considerably. The addition of camphor has been recommended as a preservative; but a few drops of strong acetic acid, in a bottle of the flies, is more effectual. A good method is to immerse the bottle containing them in boiling-hot water, which destroys the eggs of the insect,

without injuring the flies. With this precaution, and that of keeping them in bottles well-stopped, they may be preserved, whether whole or in powder, for a long time without injury.

Effects on the System. The effects of cantharides upon the system, when internally administered, have been already fully described. (See *page* 619.) In the preliminary remarks upon the class of epispastics, its remedial effects as an external agent, and the principles which should govern its therapeutic use, have been sufficiently considered. It remains here to treat of the mode of applying the medicine externally, and of the particular effects attendant on, or following the several methods of application. This brings us to the consideration of its preparations; for the flies are almost never used in an unprepared state.

The use of blistering insects was familiar to the ancients; but it is quite uncertain, from any accounts which have come down to us, whether they used the particular species now under consideration.

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1. CERATE OF CANTHARIDES.—CERATUM CANTHARIDIS. *U. S.*—EMPLASTRUM CANTHARIDIS. *Lond., Ed., Dub.*—*Emplastrum Epispasticum.*—*Blistering Plaster.*

Preparation. Though commonly designated as a plaster, and so called by the British Colleges, this preparation is not entitled to the name, which is now applied to substances requiring to be heated when spread, and adhesive at the temperature of the body, neither of which characters belongs to that here considered. It is in fact a cerate, as it is called in the U. S. Pharmacopœia. In its preparation, the finely powdered flies are thoroughly incorporated with a melted mixture of wax, resin, and lard. Suet or olive oil is sometimes substituted for lard. For the proportions, and necessary manipulations, the reader is referred to the U. S. Dispensatory.

The cerate thus made is of a consistence which allows it to be readily spread by a knife or spatula, at common temperatures.

When used, it is generally spread on leather; but a piece of thick linen or canvas, or of stout paper, may be substituted if more convenient.

When the officinal cerate is not to be had, its place may be supplied by an extemporaneous preparation, made by thoroughly incorporating two parts of the powdered flies with four parts of resin cerate, or simple cerate, previously softened by heat; and, to increase

the efficacy of the preparation, finely powdered cantharides may be sprinkled over its surface when spread, and made to adhere by gentle pressure with a roller or otherwise.

Application. As the officinal cerate is not adhesive, or but very slightly so, it is necessary to employ some method of retaining it in its place. When it is applied to the extremities, or to the head, this may be done by a neatly fitted muslin roller; but, when on the trunk, neck, or face, some other method must be employed; and none is more convenient than to fix it by means of narrow strips of adhesive plaster, one-half of which shall be attached to the back of the leather, the other half to the skin. Sometimes the cerate is spread upon leather previously covered with adhesive plaster, and a margin of the latter left uncovered, so as to come in contact with the skin.

The shape of the spread leather or cloth must be accommodated to the surface to which it is to be applied. Thus, for the forearms and legs, it should be rectangular, and nearly twice as long as broad; for the chest, back, or abdomen, nearly square, but usually somewhat longer than broad; for the back of the neck, triangular, with the upper angle truncated, so that it may be narrow at top, and spread out as the neck widens; for the space behind the ears, in the shape of a new moon, with the lower limb circularly expanded; for the whole scalp, oval; for the female breast, circular or semicircular, with a round opening in the centre; and for the epigastrium in a woman, triangular, with one of the angles extending upward over the sternum, and the base below. When a pair of blisters are made for corresponding parts on the two sides of the body, if the shape is not perfectly symmetrical, the caution must be observed to spread the two upon opposite surfaces, as in blisters behind the ears.

The size of the blister is of considerable importance. As a general rule, it should be large; as the pain and inconvenience are little increased, while the remedial impression is proportioned to the extent of the blistered surface. Care, however, should be taken not to make it so large as to endanger an oppressive effect on the system, or too extensive a disturbance of the cutaneous functions. For the forearms and legs, a pair may be used, each, for an adult man, about six inches by three or four; for the chest or abdomen, a single blister from eight to twelve inches in length, and six to ten in breadth; for the head, it should usually be made large enough to cover the whole scalp. It is a great therapeutic error to apply

small blisters in serious diseases. The patient is made to suffer almost as much as from large ones, and receives little or no compensating benefit. For children, of course, the size must be proportionably diminished.

Before applying a blister to a hairy part, the hairs should be shaved off, and, if delay be admissible, ten or twelve hours should be allowed to pass before the application is made, in order that the abrasions may heal. But no sacrifice of important time should be made for this object.

When the surface of application is convex, as the head, the shoulder, the neck, the mamma, &c., slits should be made deep into the blister from the circumference, in order that it may be fitted accurately to the part.

The surface of the skin should be moistened with water or vinegar before the application is made, in order that the active principle may be dissolved, and thus be enabled to act more quickly. When the epidermis is perfectly dry, it is sometimes difficult, without this precaution, to produce a blister.

In selecting the place of application, the practitioner will be guided by the effects to be produced. For general impression on the system, and for revulsion in cases of simple sanguineous or morbid nervous determination, without fixed local disease, the inside of the forearms or of the legs should be preferred, and the blister should be applied lengthwise along the limb; care being taken, when the application is made to the forearm, to protect a space of two or three inches at the wrist, by wrapping closely around it a linen roller, so as to prevent the blistering plaster from slipping down, and thus interfering with the pulse. When the object is to act revulsively, or through depletion, upon a local inflammation, the blister should be applied to the surface, as nearly as possible immediately over the seat of the disease. When the base of the brain is affected, the back of the neck is the nearest part to which the application can be conveniently made.

It is advisable to cover the surface of the cerate, when spread, with a piece of fine gauze, or very thin unsized paper, which scarcely interferes with the action of the cantharides, while it prevents the adhesion of portions of the cerate to the skin, when it is removed. This is specially important when the blister is applied directly over the eyes, as it sometimes is, with great advantage, in obstinate ophthalmia.

Effects of the Cerate. For a short time after the application, no perceptible effect is produced. Soon, however, a slight sense of warmth and perhaps of tingling is experienced, which is probably coincident with a moderate increase of the perspiratory function, whereby the skin becomes moist, and thus facilitates the further action of the irritant. This sensation gradually increases to a burning pain, which is sometimes very severe, sometimes quite tolerable, according to temporary or constitutional differences in susceptibility. If the surface is now examined, it is found much reddened, though not so deeply as by some of the more powerful rubefacients. In a short time, it becomes covered with innumerable vesicles, which gradually enlarge into bullæ, until at length the whole or nearly the whole of the epidermis is separated, and a light yellowish translucent liquid is collected beneath it. The liquid has been found to contain about six per cent. of albumen, with some salts, besides water. Occasionally it coagulates, and the blister appears filled with a tremulous jelly, which, however, gradually disappears under dressings.

The blister is now said to have drawn. The period required for the process various exceedingly under different circumstances. It is shorter in parts covered with a delicate epidermis than in others, consequently on the inner side of the limbs than the outer, and probably on the anterior surface of the body than the posterior. In women the process is more rapid than in men, and in children than either. In an adult man, vesication may usually begin in three or four, and be completed in from eight to twelve hours; but the latter period is often much exceeded, and the former sometimes anticipated. In hairy parts, even though shaven, almost twice as much time is requisite as for a surface destitute of hair.

During the rubefacient stage, there is generally some constitutional excitement, which has already been sufficiently considered in the general observations. But an incident frequently happens, in the course of the vesication, which it is necessary to notice. I allude to strangury. This, as before stated, when cantharides was treated of in reference to its effects on the system, is an almost constant result of its internal use, when pushed sufficiently far. It often occurs from its external application, but by no means so uniformly. There seems, in some persons, to be a strong constitutional liability, so that they are always affected; in others a constitutional exemption, so that they never suffer. The affection is undoubtedly owing to the absorption of the active principle. I have generally noticed that it

comes on only after vesication has taken place; as if the intervention of a liquid between the medicine and the absorbing surface, favoured the passage of the cantharidal solution endosmotically into the blood-vessels. The symptoms of strangury were described in the general account of the operation of the medicine; and I need not repeat them here. They are precisely the same in character, whether produced by its internal or external use (see *vol.* ii., *p.* 620).

When the vesication is complete, and the serum has escaped through spontaneous or artificial openings, the vesicated surface will usually heal kindly, if the loosened epidermis be allowed to remain, so as to protect it from the air. If it be removed, however, the surface is apt to become irritated, and sometimes severe and highly painful inflammation takes place, which occasionally ends in suppuration. The same effect takes place, in consequence of the application of irritant dressings. Under these circumstances, however, instead of forming pus, the surface often throws out coagulable lymph, which forms a protective layer against the influence of the irritant. Occasionally, from the application of severe irritants, too long continued; and sometimes without them, in persons of enfeebled constitution, and diseases attended with depraved blood, ulceration takes place, and even gangrene, which may be dangerous to life. When there is, at the same time with the use of the remedy, a disposition to erysipelas, it sometimes happens that the blistered surface becomes the seat of this affection, which spreads from it on all sides. In some very rare instances, probably in consequence of the absorption of the cantharidin, serious constitutional disturbance takes place, marked, besides the moderate febrile symptom before mentioned, with dryness of the mouth and fauces, subsultus tendinum, and even convulsions. Such cases, however, are extremely rare; and I cannot recall more than one instance, in which I thought the condition fairly ascribable to the medicine.

Treatment of the Blisters. The first question is how long the application is to continue? In general until vesication has completely taken place, or, to use the ordinary mode of expression, until the blister has fully drawn. For the most part, in an adult man, it may continue twelve hours, and upon the scalp from eighteen to twenty-four hours. It is an error to withdraw the cerate too soon. The object is not simply to vesicate. It is to establish a certain amount of inflammation in the part, sufficient for a power-

ful excitant and revulsive impression. This object is not gained, or is gained but imperfectly, with a premature removal. Circumstances, however, may require a shorter period. Thus, in very sensitive parts, and those of loose texture, the cerate may be removed in six or eight hours, because vesication takes place sooner in these parts than elsewhere; and, if the application continue, extensive inflammation, with edematous effusion, is apt to occur in the loose cellular tissue. This not unfrequently happens, when a blister is applied over the eye, or to the scrotum. The occurrence of strangury often also calls for an earlier removal than under ordinary circumstances. In children, the period of application must be much shorter than for adults. In infants under two years, the cerate should be removed in two or three hours; in a child from two to four years, in four or five hours; and these periods may be anticipated, if, on examination, it should appear that vesication had taken place. The danger is peculiarly great, in young children, from too long an application of the remedy, which may occasion mortification of the surface, especially in low cases of exanthematous fever, as scarlatina and malignant smallpox.

When the cerate is withdrawn, the subsequent treatment depends on the object aimed at. If the intention be that the blister shall heal as quickly as possible, the cuticle should be cut in the most dependent part, and at as few points, and with as small incisions, as may answer for the evacuation of the serum. This is done, in order that the epidermis may be kept as nearly as possible entire, and serve as a dressing to exclude the air. If it be wished to keep the blister open for a short time, the epidermis should be cut very freely, and at various places, particularly all around the edges of the blistered part, so that it may come away with the first dressings, and a denuded surface be left to the action of the air, and of irritant applications. The best dressing, when the blister is to be healed, is simple cerate, which should be free from all rancidity. Fresh suet also will answer very well. To maintain a moderate degree of inflammation, but one which will subside, after a short time, even under the continued application of the dressing, and ultmately heal, the resin cerate or common basilicon ointment may be used. Should it be wished to keep the blister long open, and to maintain a running purulent discharge from the surface, it may be dressed with the ointment of cantharides, savine cerate, or ointment of mezereon.

Should strangury supervene, the cerate, if still in contact with

the skin, should be instantly removed, and its place supplied with an emollient poultice. At the same time, from forty to sixty drops of laudanum may be thrown up the rectum in a wineglassful of thin starch or mucilage, and the patient drink freely of mucilaginous liquids, or water impregnated with sweet spirit of nitre. Camphor has been recommended, but I have found it of little use. The anodyne enema almost always affords prompt relief. If not, it should be repeated. In some rare instances, it is necessary to draw off the urine by a catheter.

In persons known to be liable to strangury, the cerate should be removed before vesication has fairly commenced, and before strangury has made its appearance, but after the occurrence of complete rubefaction; generally at some period between four and eight hours. If a poultice be now applied, vesication will often take place; though the inflammation may be less than in other cases.

Should the blister be *much inflamed*, red, swollen, and very painful, dressings with *cold water*, or *with solution of acetate of lead* in cold water, in the proportion of a drachm to the pint, may be used. *If it refuse to heal*, and remain obstinately open, I know no remedy equal to Goulard's cerate, or *cerate of subacetate of lead*, which will almost always enable it to heal quickly. At least such has been my nearly uniform experience.

Should ulceration and gangrene have taken place, measures must be employed, with the removal of all irritating substances from the diseased parts, and the application of emollients, to support the strength of the patient by quinia, the mineral acids, opium, the fermented liquors, and a good diet.

Contraindications. Excessive excitement in a part of feeble vitality endangers the life of the part, and gangrene is apt to follow. This law was inculcated by John Hunter, and, whatever explanation of it may be given, is a truth which cannot be gainsaid. Hence, the inflammation from blisters is not unfrequently destructive to the blistered tissue, when at the time greatly enfeebled. There is no condition, which so badly resists this effect of blisters, as that in which debility is owing to a depraved state of the blood. Blisters are, therefore, generally contraindicated in affections of this kind; at least they require to be used with great caution. The advanced stages of *typhus and typhoid fevers*, and of *malignant diseases* generally, are of this kind. Certain *exanthematous fevers*, in which it may be supposed that the blood suffers under the influence

of a poison in the system, are other examples. Thus, blisters often cause sloughing in *scarlatina*, and in low states of *erysipelas*. When the excitant and revulsive influence of cantharides is wanted in such affections, it is often better to allow the blister to remain only during the rubefactive stage, and to remove it before vesication begins. It has been stated, in the preliminary remarks on the class of epispastics, that it is safer, under these circumstances, to apply the blister to the trunk than to the extremities, because there is greater vital power of resistance in the vicinity of the heart than in the more remote parts; and, for the same reason, if applied to the extremities, that they should be put upon the thighs and arms, preferably to the legs and foreams. Other diseases in which the blood is depraved, and blisters are usually contraindicated, are *scurvy* and *purpura*, and, it may be added, *passive hemorrhages in general*. In the *distended limbs of dropsical patients*, the vital powers are so much reduced, that a slight irritation is often sufficient to cause sloughing, and blisters of course are hazardous.

2. CANTHARIDAL COLLODION.

Though not adopted in the American or British Pharmacopœias, this is an excellent vesicating preparation, and now much employed as a substitute for the cerate. It consists of an ethereal extract of cantharides, dissolved in collodion, which is a solution of gun cotton in ether. The preparation is made in different modes, for an account of which, the reader is referred to the U. S. Dispensatory. It should be kept in glass-stoppered bottles accurately closed, so as to prevent the escape of ether. When it is applied to the surface, the ether rapidly evaporates, leaving a coating with powerful vesicating properties, closely attached to the skin. The application may be made by means of a camel's-hair pencil; and, as the ether evaporates in less than a minute, may be repeated once or oftener, without inconvenience, if the part has not received a sufficient coating. It produces a blister in about the same time as the cerate, over which it has the advantages, that it may be more easily applied, retains its place better, and may be made to fit unequal surfaces more accurately. If the ether be prevented from evaporating by means of oiled silk, its own stimulating property aids that of the flies, and vesication takes place more speedily.

3. PLASTER OF PITCH WITH SPANISH FLIES.—EMPLASTRUM PICIS CUM CANTHARIDE. *U. S.*—EMPLASTRUM CALEFACIENS. *Dub.*—*Warming Plaster.*

This is a preparation of the cerate of cantharides just treated of,

made by melting together one part of the cerate and seven of Burgundy pitch.

It is intended rather as a gentle rubefacient than as an epispastic, though it not unfrequently produces the latter effect, especially when carelessly or inaccurately prepared. Whenever the particles of cantharides are brought into contact with the skin, each particle exerts its own full influence on the portion of skin touched, which may end in the vesication of that point. Hence the difficulty of diluting powdered cantharides so that they will not vesicate, if they produce any effect whatever. To obviate such a result, the best plan is to bring the active matter into the liquid form, in which its particles are infinitely divided, and thus become susceptible of indefinite dilution. It would be better, therefore, in preparing the warming plaster, to incorporate with the Burgundy pitch an oleaginous solution of the active matter of cantharides, and this can be accomplished by melting the portion of the cerate here directed, and allowing it to remain in this state until the oily matter has thoroughly dissolved the cantharidin, then straining, and incorporating it with the melted pitch.

When this plaster can be made so as not to vesicate, it is an excellent application in cases of obstinate lumbago, and of chronic internal inflammations, as pleurisy, pneumonia, bronchitis, hepatitis, &c. It may be continued for weeks, and, with occasional renewals, for months if necessary. As it is a plaster, it requires heat to spread it.

4. **OINTMENT OF CANTHARIDES.**—UNGUENTUM CANTHARIDIS. *U. S., Lond., Dub.*—UNGUENTUM INFUSI CANTHARIDIS. *Ed.*—*Ointment of Spanish Flies.*

This is prepared by incorporating a concentrated decoction of cantharides with melted resin cerate, or basilicon ointment. It is a much weaker preparation than the preceding, and is employed chiefly as a dressing for blisters, in order to keep them open, and maintain the discharge. It should not be used in persons liable to be attacked by strangury, under the external use of cantharides. It may also be employed as a stimulating or rubefacient liniment.

5. **LINIMENT OF CANTHARIDES.**—LINIMENTUM CANTHARIDIS. *U. S., Dub.*

According to the U. S. Pharmacopœia, this is made by digesting cantharides in oil of turpentine. It is a powerfully stimulating and also vesicating lotion, which was first prepared by the late Dr. Joseph Hartshorne, of Philadelphia, who used it in very low states of typhus fever. It is applicable only to conditions of great pros-

tration, in which a rapid and at the same time sustained impression is required. It may be applied as a lotion to the inside of the thighs. Care must be taken, in using it, not to produce too extensive a vesication. When this effect is not wanted, it has little or no advantage over the oil of turpentine itself. When considered too strong, in any particular case, it may be diluted with olive oil. In the Dublin preparation the virtues of the flies are extracted by means of this oil, instead of the oil of turpentine.

6. **TINCTURE OF CANTHARIDES.**—TINCTURA CANTHARIDIS. *U. S., Lond., Ed., Dub.*

The U. S. preparation contains the virtues of an ounce of the flies in two pints of diluted alcohol. The preparation of the British Colleges is much weaker. This preparation is chiefly employed internally. (See *vol.* ii. *p.* 623.) It may, however, be used as an external stimulant, either alone, or as an ingredient in compound stimulant lotions. As a mere rubefacient, however, it has nothing to recommend it over other substances, not liable to the objection of occasionally blistering; and, as an epispastic, it is much inferior to other preparations of the flies.

Other species of Cantharis, and insects of the genera *Mylabris* and *Meloe*, all belonging to one natural family, possess the same vesicating property as Cantharis vesicatoria; and several have been used, or are now used, in different parts of the world, for the same purposes. We have in the United States several fine species of Cantharis, which have been found to equal the European species in virtues. One of these, the *Cantharis vittata* or *potato fly*, is recognized in our national pharmacopœia; and *C. Nuttalli*, which is said to be abundant beyond the Mississippi, is a large and beautiful insect, which will probably at some future period enter into our officinal catalogue.

II. STRONGER SOLUTION OF AMMONIA.

LIQUOR AMMONIÆ FORTIOR. *U.S., Lond., Dub.*—AMMONIÆ AQUA FORTIOR. *Ed.*

Preparation and Properties. This is prepared by receiving gaseous ammonia in water, until it becomes nearly saturated. As directed by the U. S. Pharmacopœia, the preparation has the sp. gr. 0.882 and contains 29 per cent. of ammonia, while the strongest solution

contains only 32.5 per cent. As kept in the shops, however, it is seldom of the officinal strength; and, if it be so at first, can scarcely be kept so long, when at all exposed to the air, in consequence of the rapid escape of ammonia. It should be kept in well-stopped glass bottles in a cool place.

It is a colourless liquid, of an insupportably pungent odour, and of a burning, acrid, alkaline taste, when sufficiently diluted to be admitted into the mouth. It has in a high degree all the alkaline properties.

Effects on the System. We have here to consider only its local effects. When applied to the surface, if of the officinal strength, it is so rapidly caustic, and on exposure emits suffocating emanations so copiously, that its use in an undiluted state is very inconvenient. For application as a vesicating agent, it should be reduced, if of unimpaired strength, by the addition of about an equal measure of water; but, as often found in the shops, it is comparatively so feeble that it may be employed undiluted. In the dilute form, it first reddens, then vesicates, and ultimately cauterizes, and all generally within a period of fifteen minutes. For its vesicating effect, it may be used when cantharides cannot be employed on account of the extreme susceptibility to strangury, and when it is desirable to raise a blister very promptly, as in cases of great and sudden prostration from gouty spasm in the stomach, anginose affections of the heart, the sinking spells of low fever, &c., and intolerable neuralgic or spasmodic pains. It may be employed, also, to obtain quickly a denuded surface for the endermic application of medicines, in cases of great emergency. It may be most conveniently applied by saturating with it a compress of folded linen, or a piece of dense coarse flannel, which must be covered with a thick towel. For procuring a small blister, the top of a large wooden pill-box, or a large watch-glass, may be filled with patent lint, saturated with the liquid, and then inverted and pressed upon the skin, so as to prevent the escape of the gas. A blister is produced usually within ten minutes, and sometimes so soon as five, or even three minutes; after which it should be removed, in order to avoid cauterizing.

A vesicating ointment may be made by mixing the stronger solution of ammonia with lard and almond or olive oil, in the proportion of one part of the solution to two of the oily matter. For the precise mode of preparing it, see the *U. S. Dispensatory* (10th ed., p. 85). It may be kept in a glass bottle well-stopped, and used as required. It will produce a blister in ten minutes.

CLASS II.

RUBEFACIENTS.

RUBEFACIENTS are characterized by producing inflammation of the skin, without vesication. Though most of the more active substances belonging to the class will blister, if allowed to remain long in contact with the surface, they are less disposed to produce this effect, with the same amount of inflammation, than the epispastics, and are not used for the purpose. As before stated, there is a set of external irritants which, though they do not vesicate in the strict sense of the term, produce a pustular eruption. These, for the sake of convenience, I include as a subsection under the present head, as they fulfil similar indications.

The principles upon which the rubefacients operate therapeutically are the same, in general, as those of the epispastics, though with some differences which I will point out. But first it is necessary to understand that there are grades of power in the rubefacients, from the feeblest up to the most violent; so that we can obtain from them a speedy and powerful, or a slight and prolonged effect, as we may desire.

In relation, then, to their principles of operation, they agree with the epispastics in stimulating generally as well as locally, in producing the effects of a shock on the system, in their revulsive influence, their property of substitution, and their capacity of producing pain. But they do not deplete materially, and cannot, of course, be used for obtaining a denuded surface.

In relation to their effects on the system at large, when a permanent and energetic effect is wanted, blisters are generally preferable to rubefacients; but for a very prompt and very powerful impression, we must have recourse to the most active of the latter class. Hence, these are preferably used in cases of sudden and extreme but transitory prostration; as in the cold stage of malignant and pernicious fevers, cholera, protracted syncope, and the sudden collapse from violent injuries; while blisters are more effectual, by their sustained effect in supporting the system, when support is

necessary, after reaction; and are more efficient in breaking up morbid associations, as in paroxysmal diseases.

The extent of surface over which the operation of the rubefacients may be extended, their more superficial action, and their less liability to be followed by sloughing, adapt them better to the treatment of that condition of debility, in the advanced stage of low fevers, in which the skin is cold, and the capillary vessels generally inert. They are, under these circumstances, greatly preferable to blisters.

In regard to the local effects of the two classes, when operating on the principle of revulsion, blisters are much more efficacious in inflammation, rubefacients in the more violent forms of nervous disease. Thus, in a case of severe spasm of the stomach, or excessive nausea and vomiting, it is better to have recourse to the speedy and powerful operation of a mustard cataplasm; in gastritis, to the longer continued, though less energetic action of a blister.

It often happens that one of the active rubefacients may be used for its prompt effect, while blisters may afterwards come in to maintain the revulsive impression. Thus, in cases of sudden cerebral congestion, we apply a pair of sinapisms to the extremities, but afterwards, should the affection continue, put a blister on the back of the neck and between the shoulders.

At the very commencement of inflammation, when there may be some hope of breaking up the disease by a prompt and violent revulsive impression, the active rubefacients are sometimes preferable to blisters, not only from their greater quickness and energy, but also from the brief duration of their action, which is not carried onward with the disease, like that of blisters, should the effort to arrest it fail.

In chronic cases of slight but persistent inflammation, and in prolonged internal nervous disorder of a mild character, in which it is desirable to maintain a long continued and steady, but feeble counter-irritation, the gentler rubefacients are better calculated than blisters to meet the indication, as less uncomfortable to the patient, and less disturbing to the system, while perhaps equally effective in eradicating the complaint.

The depletion produced by blisters, which is often considerable and effective, adapts them much better than rubefacients to subcutaneous inflammations, whether in the areolar and adipose tissue, the blood-vessels, nerves, or absorbents.

For the effect of pain on the system, the more powerful rubefacients are not less effective than blisters. The extreme pain

of a sinapism is more likely to divert the mind from an imaginary trouble even than that of a blister, though the impression may not be so permanent.

The following are rubefacient remedies, which, in accordance with the plan of the work, though not properly medicines, require a brief notice in this place.

1. HEAT AS A RUBEFACIENT.

Heat applied to the surface, in the modes treated of under diffusible stimulation (i. 482), cannot be regarded as rubefacient. It acts on the whole system directly, by means of the blood, which conveys everywhere through the body the heat it receives at the surface. But it is sometimes employed with a view simply to the local inflammation it produces, and thus properly falls into the present category.

Rubefaction may be effected either by water not sufficiently hot to vesicate, applied by means of cloths or the douche, or by a stream of hot air, or by a solid body heated. The last is the most convenient method, and has been considerably used in the treatment of chronic rheumatism. A smooth piece of iron, furnished with a handle, having been heated somewhat above 212°, may be applied lightly to the skin, and passed rapidly from point to point, till the desired extent of surface has been covered. The skin is first whitened, but soon becomes red and inflamed; and, by careful manipulation, a rapid rubefaction can thus be obtained, without cauterization, or even vesication. It is obvious that this measure might be applied extensively for the general purposes of the rubefacients; but the chances of injury from unskilful or careless manipulation, and the painful character of the inflammation produced by heat, tend very much to limit its employment.

2. FRICTION AS A RUBEFACIENT.

This is a most valuable remedy. Independently of its effect in restoring the functions of the torpid surface by direct excitation, it operates revulsively with considerable energy. It may be questionable whether this is a proper place to introduce a consideration of the remedy; and certainly, it is seldom carried to the point of producing absolute inflammation. Yet it acts upon the same general principles with the milder rubefacients, and I do not know where to place it more appropriately.

By friction, both the blood-vessels and the nerves of the skin are

excited; the blood and nervous energy, therefore, flow into it from the interior non-sympathizing parts; and, from the extent of surface to which the measure may be applied, the whole amount of revulsive influence may be very considerable. It should be resorted to in all cases in which the skin is depressed in its function, cool, unperspiring, and pale, and even when copiously perspiring, if this condition depend on relaxation or debility of the surface. It may also be employed in cases of chronic internal inflammations, and irritations, whether nervous or vascular, when the skin is not already over-excited, and no febrile action exists. No matter what may be the seat of the affection, whether in the head, chest, or abdomen, the remedy is still applicable.

In cases of simple nervous irritation, or slight vascular congestions of an acute character, it may often be advantageously resorted to. In abdominal pains, stomachic or intestinal, neuralgic or spasmodic, brisk friction over the abdomen will often yield complete relief. In subacute or nervous rheumatism, affecting the muscles or internal parts, the same remedy is sometimes promptly efficient.

Generally speaking, the measure is more effective when performed by another than by the patient, unless in cases in which it may be indicated as a means of exercise. The mildest method of performing it is with the hand. A coarse linen towel, or a piece of firm flannel may also be used. The most effectual method is probably with the flesh-brush. It may be applied to a part, or the whole of the body; but the more extensively, in general, the better, even though it should be proportionately less violent; unless when the object is to act on some special organ, by revulsion to the surface immediately over it. Another mode of accomplishing the same object, is by beating the whole surface with some yielding instrument, that cannot well bruise, such as a slipper; which Dr. Cartwright, of New Orleans, assured me, he had found very useful in neuralgic affections, with a pale and inert condition of the surface.

Shampooing acts, in part, on the same principle; but not altogether, as the effects of this measure are extended also directly to the interior organs.

3. ACUPUNCTURE.

This measure was unknown to the ancient Greeks and Romans, but appears to have been in use from time immemorial in China and Japan, whence it was introduced into Europe. Though noticed so early as 1683 by Kœmpfer, no practical use of it was made until a comparatively very recent date. In 1816 M. Berlioz, of Lyons,

called the attention of the profession to the remedy; and M. Bretonneau afterwards performed a series of experiments which served to fix its value as a remedy. (*Trousseau and Pidoux.*)

Acupuncture consists in the introduction of sharply pointed and very smooth needles, through the skin, into the tissues beneath. It is stated, as the result of numerous experiments, that all kinds of structure, muscles, blood-vessels, nerves, parenchymatous tissue, membranes, even the brain, may be thus penetrated without serious injury, if the needle be not allowed to remain too long. The sharp point seems to insinuate itself in such a mode as scarcely to wound, but merely to separate the ultimate components of the tissues. Steel needles are perhaps on the whole preferable, as being the sharpest, and susceptible of a very high polish; but silver, platinum, and gold have been recommended; and the two last have the advantage that they undergo no chemical change.

The introduction of the needle is, in some instances, apparently painless, in others very painful; but, in most, it produces a moderate uneasiness, which the patient finds easily supportable. Almost always a little redness and heat are perceptible about the place of insertion. If allowed to continue, the needles often produce considerable inflammation in their course.

When the space to be operated on is limited, only a single needle is introduced; when it is extensive, several.

In the introduction of the needle, the skin should be rendered tense, the point gradually insinuated, and the instrument rotated between the fingers.

The length of time, during which the needles should be allowed to remain, varies with the effect. In simple neuralgia, they may afford relief in five or six minutes; in more fixed affections, often not before half an hour or an hour; and sometimes days elapse before the end is accomplished: but the rule is to allow them to remain until the pain is relieved. There is, however, some risk of injurious results from inflammation, if they are suffered to continue too long.

The complaints in which they have been most effectual are those of a *neuralgic*, *rheumatic*, and *spasmodic* character. The needle is introduced into the painful tissue.

How does acupuncture operate? I have no doubt whatever that, in many instances, it acts through the mind, as the cold steel of the dentist will cure the toothache before the tooth has been pulled, or as the metallic tractors, and the homœopathic globules cure neuralgia and rheumatism. The relief is not the less positive because

thus obtained. Perhaps there is still a revulsive action. The excitation of the cerebral nervous centres, diminishes irritation elsewhere; and, if the impression has been sufficiently strong, the relief may have a considerable degree of permanence.

But I am quite disposed to believe that there is also a more limited revulsion; the irritation which produces the pain of the disease, being diverted from its original seat towards the course of the instrument.

I shall consider the rubefacients in the two divisions of the simple inflammatory, and the pustulating. It will be seen, hereafter, that there is some difference in their mode of therapeutic operation, which justifies this arrangement.

1. *Simple Inflammatory Rubefacients.*

I. MUSTARD.

SINAPIS. *U. S., Lond.*—SINAPI. *Ed.*

Origin. Under this title are included the seeds of two species of Sinapis, the *Sinapis nigra* and *S. alba*, or *black* and *white mustard.* Both of these plants are natives of Europe, and both cultivated in our gardens.

1. BLACK MUSTARD SEED.—*Sinapis Nigra.* Dub.—These are roundish, about the size of a small pin's head, somewhat rugose on the surface, of a dark-brown or reddish-brown colour externally, yellow within, inodorous in the whole state, slightly odorous when bruised, of a pungent odour upon contact with water, and of a hot, very pungent, bitterish, and oleaginous, but not very durable taste. Their powder is originally yellowish-gray, owing to the intermixture of particles of the brown coating, from which it is separated by sifting, and thus becomes purely yellow. It is sometimes, however, in its original state, as kept by the druggists.

2. WHITE MUSTARD SEED.—*Sinapis Alba.* Dub.—White mustard seed are also roundish, somewhat larger than the black, of a dull-yellowish colour externally, yellow within, inodorous, and of a taste similar to that of the black, but less pungent. They are peculiar in yielding to hot water a large proportion of thick mucilage. They have already been considered, in reference to a laxative property possessed by them (ii. 468).

Common Properties. When pulverized and sifted, mustard seeds yield a yellow powder, usually called *flour of mustard*, or simply *mustard*, much used as a condiment. From the siftings, there is obtained by compression a bland fixed oil, occasionally used in the arts. The sifted powder is often mixed with wheat flour, coloured with turmeric, and rendered pungent by cayenne pepper, before being delivered to commerce. The apothecary should endeavour to supply himself with the unadulterated powder. This is soft, of an unctuous aspect, and somewhat disposed to cake. It imparts all its virtues to cold water, but imperfectly to alcohol.

Composition. Besides the fixed oil above referred to, and other principles of less importance, mustard contains certain ingredients, which, though inert when applied to the surface dry, or mixed with alcohol, undergo a mutual reaction with water, which renders the powder extremely irritant. These principles are not exactly the same in the two varieties of mustard. The following is an epitome of our present knowledge on this subject, which, however, requires further investigation.

In both black and white mustard there is a peculiar principle, denominated *myrosyne*, which acts the part of a ferment, and in character is very analogous, though not identical with the emulsin of sweet and bitter almonds. In the black variety there is, besides this principle, another, supposed to possess acid properties, and called *myronic acid*, which is thought to be combined with potassa, forming *myronate of potassa*. In the white variety, instead of this principle, there is another of peculiar properties, called *sulphosinapisin*, from the circumstance that it contains sulphur, as also does myronic acid. Now, when water is added to mustard, a reaction takes place between it and the peculiar principles of the two varieties, through the instrumentality of the myrosyne, by which new products result, quite different in their properties from those pre-existing in the seeds. The *myronic acid* of the black mustard forms, by this reaction, a volatile oil, which may be obtained by distillation, is extremely volatile, and imparts to the powder great pungency of smell, and a strongly pungent and acrid taste. The *sulphosinapisin* of the white mustard, by the same reaction, forms also a very acrid and pungent substance, which, however, is not volatile; and, therefore, though little less acrid to the taste, or irritant to the surface than the volatile oil of the black variety, does not impart the same pungency of smell to the powder.

From what has been said it follows, that, to develop the activity

of mustard, the presence of water is necessary. *Myrosyne*, through the instrumentality of which the changes are effected, is coagulated and rendered inert by heat, alcohol, and the acids. Hence, the rubefacient property of mustard is not evolved by alcohol; and the application of heat, or admixture of acids, interferes with its activity. The odour evolved, on the addition of water to the powdered black mustard, is very striking; while no such effect is produced by strong alcohol. The reader who may wish further knowledge on this subject, will find a more detailed account of the chemistry of mustard in the *U. S. Dispensatory* (10th ed., pp. 683, 4, 5). The important practical inference from all this is, that, in order to secure the efficiency of mustard as a rubefacient, it is necessary to mix it with water; and that heat, alcohol, and the acids, so far from increasing its power, have the effect of enfeebling it, or rendering it inert.

Effects on the Skin. The effects of mustard, taken internally, have been sufficiently considered (ii. 443, 468, 624). When applied to the surface, in the form of a cataplasm, it is one of the most powerful rubefacients, and practically perhaps the most useful of the class. Though capable of producing the most violent effects, it may by dilution be reduced to any desirable degree of mildness, and may consequently be graduated to almost any condition, calling for the temporary use of these remedies. If used undiluted, it generally produces a feeling of warmth within ten or fifteen minutes, which gradually deepens to a burning pain, and, at the end of from thirty to forty minutes, becomes so violent as to be almost insupportable. Few patients will bear a cataplasm of pure mustard longer than three-quarters of an hour. The surface, on its removal, is found intensely red and somewhat elevated; and the burning pain continues, with gradual mitigation, for a considerable time, occasionally for hours; and, when it disappears, generally leaves some degree of soreness behind. Desquamation of the cuticle after a time takes place, a new cuticle being formed without any secretion of liquid. By shortening the period of application, or diluting the mustard, any amount of rubefacient effect can be obtained, from the intensity just described, down to a scarcely perceptible, and very fugitive redness.

If, however, the application be continued too long, the cuticle separates, and an imperfect vesication takes place, which leaves behind a denuded and most painful surface, indisposed to heal kindly, and sometimes going on to suppuration. Ulceration also not un-

frequently occurs under these circumstances, and sometimes gangrene, especially in children, and patients with a feeble constitution and depraved blood. Such a result is to be particularly guarded against in scorbutic, malignant, and typhous affections.

In comatose conditions, there is great insusceptibility to the painful impression of mustard, as in cases of apoplexy and narcotic poisoning. Nevertheless the application is not without effect. Sometimes the inflammation is obvious, though not sensible to the patient. In other instances, no apparent effect is produced during the prostrated state; but, on the occurrence of reaction, violent inflammation takes place, sometimes with very unpleasant consequences. In a case of poisoning from opium, in which, after the evacuation of the poison, the patient was left extremely prostrate, sinapisms were applied to the inside of the legs, and were allowed to continue for three hours, without the least apparent effect: the skin being in no degree reddened, and the patient quite insensible. Upon reaction, however, though the sinapisms had been long removed, the most violent inflammation came on, with an outline exactly corresponding with that of the application. This was followed by separation of the cuticle, ulceration, and suppuration; and it was long before the parts could be healed. This happened to me when a young practitioner, and was a useful lesson. I have never since allowed undiluted sinapisms to remain longer than three-quarters of an hour, or at furthest an hour, in contact with the skin.

Therapeutic Use. Mustard, externally used, is a most valuable medicine; and there are almost countless occasions for its employment. It may be resorted to in all cases, in which the indications are to rouse the system from a state of torpor, to stimulate it in sudden prostration, to divert from the head in congestive states of the brain, or to act revulsively from internal organs towards the surface, in neuralgic pains, violent spasm, or any other form of nervous derangement. The chills of malignant or pernicious fevers; the prostration from violent injuries; the collapse occurring in the course of fevers or other acute diseases; apoplexy, hemiplegia, coma, and convulsions of almost every variety; angina pectoris and dyspnœa; severe spasm of the stomach, bowels, bladder, &c.; gastralgia, enteralgia, and nephralgia; violent vomiting, cholera, and cholic, are but a portion of the diseases, in which the external use of mustard is strongly indicated. When employed for a general impression on the system, or to divert from the brain, the sinapisms should for the most part be applied to the extremities; when for the relief of complaints of the chest or abdomen, immediately

over the seat of the affection. Few remedies are more efficient in violent vomiting, and gastric spasm, than a sinapism to the epigastrium. Though less effective than blisters in internal inflammation, mustard may be employed when from any cause these remedies cannot be used. To recall retrocedent gout and rheumatism, nothing perhaps is more effective than a sinapism applied to the former seat of the affection. But caution is necessary in the use of this remedy in any external disease, dependent on constitutional disorder. They should rarely be ventured upon in gout or rheumatism, seated in the muscles or the joints. I once knew death from violent pectoral disease, which apparently resulted from retrocession of lumbago, under the influence of a powerful local irritant to the back.

Application. Mustard is almost always applied in the form of cataplasm, to which, when prepared with this medicine, the name of *sinapism* is given. It should always be prepared with cold water, and brought to a perfectly soft consistence, just short of diffluence. It is a mistake to mix mustard with vinegar or hot water, both of which tend to impair its efficiency. In my early practice, thinking to increase its activity, I on one occasion mixed it with alcohol, and was surprised to find no effect produced by it. The cause of this is now understood. When the sinapism is applied, its surface should be covered with gauze or extremely thin muslin, in order to prevent any portion from adhering to the skin when it is removed. Should a mild effect be required, it may be diluted with wheat or rye flour, or meal of Indian corn, in proportions to meet existing indications. When applied to children, or to the extremities of adults in diseases impairing the state of the blood, it should always be thus diluted, equal parts of the mustard and of the substance used, being ordinarily mixed together. But in severe affections of the stomach, bowels, and chest, it should be applied unmixed.

After the removal of the cataplasm, if the inflammation excited be considerable, simple cerate should be used as a dressing. If violent, it should be abated with dressings of cold water, or saturnine solutions. When a raw surface remains after the removal of the cuticle, Goulard's cerate is the best application.

The volatile oil of mustard has been used as a rubefacient, 30 drops being dissolved in a fluidounce of alcohol, or 6 or 8 drops in a fluidrachm of olive oil. In this country, however, it is seldom if ever employed.

II. CAYENNE PEPPER.

CAPSICUM. *U. S., Lond., Ed., Dub.*

Cayenne pepper has been treated of so fully among the arterial sedatives (i. 555), that nothing is now required but a few observations upon its rubefacient properties and uses.

Applied to the surface of the body, in the form of a cataplasm, or that of a liquid impregnated with its active properties, cayenne pepper causes a burning pain with inflammation, and, if the surface of application be considerable, a decided stimulant impression on the system generally. It very seldom occasions vesication, and I have never known sloughing to result from it. On the contrary, it seems to be possessed of properties, which render it specially useful in inflammations with a sloughing tendency, at least as this condition is exhibited in the fauces, in malignant sore-throat and scarlet fever. Though generally less powerful, it is safer than mustard; and there is one condition, in which I have seen it, when accompanied with heat in its application, more efficient in exciting the surface and the system than even that energetic rubefacient. The condition alluded to consists in coldness and paleness of the surface, united with more or less comatose insensibility. In low states of the system in typhus and malignant fevers, and in the prostration following the immediate effects of the narcotic poisons, it is an excellent remedy. It should, in such cases, be mixed with heated brandy, and, by means of flannels wrung out of the mixture, should be applied extensively to the extremities, and often also to the trunk of the body, as hot as may be consistent with the safety of the skin. It is much used also as a stimulant in subacute and chronic rheumatism; but I am always fearful of applying local repellent remedies in the former of these affections. Its use as a gargle in the sore-throat of scarlet fever, and as an external irritant in the forms of that disease with insufficient eruption, has already been mentioned. A cataplasm made with heated spirit may be applied to the sides of the neck, over the parotids, in the same affection. The powder, thickly sprinkled upon the inside of stockings, has sometimes proved useful in the habitual cold feet of dyspepsia. The officinal tincture is occasionally serviceable in chilblain, and in cases of relaxed uvula, applied by means of a hair pencil directly to the part.

III. TEREBINTHINATE SUBSTANCES.

A considerable number of substances, of a terebinthinate character, are used as external irritants or alteratives, which can be considered in no place more conveniently than the present. They have all or nearly all been noticed elsewhere, in reference to their effects on the system.

I. OIL OF TURPENTINE.—OLEUM TEREBINTHINÆ. *U. S., Lond., Ed., Dub.*

This is an excellent rubefacient, acting rapidly and efficiently on the skin, especially when applied hot. There is, however, extraordinary difference of susceptibility, in different individuals, to the local irritant influence of the oil of turpentine. While some are little affected by it even in a concentrated state, others suffer extremely, though it may be largely diluted, the skin being not only reddened, but breaking out profusely with eczematous vesicles, with much swelling, redness, and pain. Great blame is sometimes attached to practitioners in consequence of this idiosyncrasy; so that they should be on their guard in using the oil externally, and feel their way cautiously, when there is no special urgency in the case. A slight trial will be sufficient to determine, whether this peculiar liability exists in any particular case. The oil is an excellent rubefacient, in the *low states of fever attended with a cold skin*, whether in the first stage of malignant chill, or in the prostration occurring in the advanced stages. It is also much used, as a local stimulant, in *paralytic conditions* of the extremities, when not associated with acute lesions of the nervous centres, in *chronic rheumatism, sprains of the joints, neuralgic pains, sore-throat, chilblains*, &c. It has been found useful in *deafness*, associated with defective secretion of wax, being introduced cautiously into the external meatus. It is highly esteemed by some in the treatment of *burns*, particularly when attended with sloughing; and has been thought to be useful in *gangrene of the extremities*, and in *anthrax*.

As an application over the whole abdomen, in cases of *puerperal peritonitis*, it has been strongly recommended; and it may be employed with probable advantage, as a substitute for blisters, in most cases of abdominal inflammation, attended with an enfeebled state of system, or after depletion, general and local, has been carried sufficiently far. It may be used either as a lotion, or applied on flannel saturated with it, and laid closely upon the part. When used to

excite the system, in cold states of the surface, it should be previously heated; but care must be taken, in heating it, that it does not take fire, through its ready volatility and inflammability.

II. BURGUNDY PITCH.—PIX BURGUNDICA. *U. S., Lond., Ed., Dub.*

Origin. This is the product of at least two different species of Abies, the *Abies excelsa* or *Norway spruce*, and *Abies picea* or *European silver fir;* both lofty and beautiful trees, growing in the middle and northern regions of Europe. It is obtained by removing portions of the bark, and collecting the juice which exudes and concretes on the wounded surface. This is then melted with water and strained. Much, however, of what is sold for Burgundy pitch is a purely factitious substance. It often contains impurities as imported, from which it may be freed by melting it in hot water and straining.

Properties. Burgundy pitch is hard, brittle, opaque, of a brownish-yellow colour, and a feeble odour and taste, resembling those of turpentine. It is readily fused by heat, and has the property, which gives it character as a plaster, of softening and becoming adhesive at the temperature of the surface. It contains resin, water, and a little volatile oil, and depends, probably, for its rubefacient power, upon the last mentioned ingredient.

Medical Effects and Uses. Burgundy pitch is in general gently irritant, producing, when spread on leather and applied to the skin, a feeling of warmth, tingling, and itching, with some increased secretion, and a very slight inflammation. On some persons, however, like oil of turpentine, it acts as a violent irritant. A person consulted me for excessive swelling and redness of the scrotum, which was covered with eczematous vesicles. Upon inquiry, I learned that he had shortly before been scraping an old Burgundy pitch plaster, which had on a former occasion been applied to his leg, and that the plaster at that time had produced an effect on the leg similar to that of which he was now complaining on his scrotum. It appeared that the present complaint originated in his having applied his hands, covered with the powder from the scraped plaster, to the seat of the affection.

In the form of plaster, spread on leather, this product is much used, as a mild rubefacient, in rheumatic affections of the muscles and joints, moderate cases of spinal irritation, and internal chronic inflammations, as catarrh, pneumonia, pleurisy, hepatitis, &c. It may be worn a long time, and, operating very gradually, is safe in

lumbago, sciatica, and pleurodynia, when more active rubefacients might endanger a transfer to internal parts.

III. CANADA PITCH. — PIX CANADENSIS. *U. S.* — *Hemlock Pitch.* — *Hemlock Gum.*

Origin. This is obtained from *Abies Canadensis*, or the *common hemlock spruce* of this country, inhabiting the British Provinces, our own Northern States, and the hilly regions of the interior further south. It is prepared by removing the concrete exuded juice, which is found upon the bark of the older trees, and purifying it by heating in water, and straining. As brought to the shops, it generally requires, in consequence of its impurities, to be again melted in water and strained.

Properties. In cold weather it is hard and brittle, but in summer is so soft as to take the shape of the drawer in which it may be placed. Its colour is a yellowish-brown, which becomes almost black on exposure. It has a slight peculiar odour, and very little taste. Its constitutents are resin, water, and a minute proportion of volatile oil.

Medical Properties and Uses. Its effects and applications are precisely the same as those of Burgundy pitch. The only point in which it is inferior is, that it melts somewhat more readily, and, at the heat of the body, is generally a little too soft, so that the plaster does not well retain its place. In this respect, it would probably improve with age.

IV. TAR. — PIX LIQUIDA. *U. S.*, *Lond.*, *Ed.*, *Dub.*

Of this I have already treated in reference to its origin, properties, effects when internally administered, and those of its vapour when inhaled. (See *pages* 606 and 673.) Applied to the skin, it is slightly irritant, and produces a mild rubefacient effect; but it is not used in its undiluted state. In the form of ointment, either through its stimulant property, or by an alterative influence, it has a most favourable effect in obstinate, chronic diseases of the skin, in which it is a very useful remedy. I have found it peculiarly useful in the scaly affections, in the advanced stages of eczema and impetigo, and in porrigo, favus, or scald-head. I know no local remedy superior to it in these affections, if any equal. It should not be employed in the early stages, nor during the existence of any general excitement; and, for fear of retrocession, it is best to apply it on different parts of the surface successively, when the disease is extensive. It is also sometimes useful as a stimulant to

chronic and indolent ulcers. Tar-water is occasionally used for the same purposes, but is less effectual.

Tar Ointment (UNGUENTUM PICIS LIQUIDÆ, *U.S.*, *Lond.*, *Ed.*, *Dub.*) is made by melting equal parts of tar and suet. It is sometimes proper to dilute it with a little lard, upon its first application in skin diseases, especially when there is any doubt of their sufficiently chronic character.

V. CREASOTE. — CREASOTUM. *U. S.*, *Lond.*, *Ed.*, *Dub.*

This is probably more valuable as an external than as an internal remedy. In the latter capacity, it has been considered among the stimulant diuretics (ii. 609). It depends for its topical efficiency, upon the following properties; 1. that of stimulating or altering the skin, 2. that of correcting fetor and arresting putrefaction, and 3. that of coagulating albumen.

1. As a topical stimulant or alterative, it is used in chronic cutaneous eruptions, especially those of a scaly character, in deafness from defective secretion in the meatus externus, in burns and chilblains in which it is asserted to be very useful, in chronic indolent ulcers, and as an injection into fistulous sores.

2. With a view to its antiputrescent qualities, which are very extraordinary, it is used as a gargle in the sloughing sore-throat of scarlatina, and as a wash in sloughing burns, gangrenous ulcers, and offensive sores of all kinds, whether cancerous, scrofulous, or syphilitic. It corrects the offensive odour in these cases, while it is also useful by its stimulant property.

3. Its power of coagulating albumen renders it, in some instances, useful in arresting hemorrhage from the small vessels of wounded surfaces; and its efficacy in toothache, when introduced into the carious hollow, is probably owing, not only to its benumbing influence on the nervous tissue, but to the protection it affords against the irritant influence of the air, by coagulating the albumen of the liquid secretion, and thus giving it an impervious coating. It is probably useful also in the same way in many ulcers.

Application. To indolent and diseased ulcers, it may be applied undiluted, by means of a camel's hair pencil, and produces on their surface a white coating, which is probably coagulated albumen. In toothache, the cavity should first be carefully cleansed, and the creasote then introduced by means of a hair pencil, and afterwards dropped on a piece of cotton. One drop may be applied at a time, and will often succeed, not only in arresting the pain, but in removing it permanently. For application to cutaneous eruptions, it may

be used in the form of aqueous solution as a wash, or in the state of ointment. In the form of solution, it is also used as a gargle in putrid sore-throat, to correct the fetor of offensive ulcers, and for arresting hemorrhage. In deafness, the meatus is to be washed out, and a solution of one part of creasote in four parts of oil of almonds is to be thoroughly applied, by means of a camel's-hair pencil.

The *solution of creasote*, or *creasote water*, is made by dissolving one part in eighty parts of water. It may be weakened if thought desirable.

Ointment of Creasote (UNGUENTUM CREASOTI, *U. S.*, *Lond.*, *Ed.*, *Dub.*) consists of half a fluidrachm of creasote mixed with an ounce of lard.

VI. RESIN.—RESINA. *U. S.*, *Lond.*, *Ed.*, *Dub.*

Origin and Properties. This is the substance left after the distillation of the volatile oil from turpentine. It is commonly called *rosin* in this country, and *colophony* in Europe. There are two varieties of it, one simply the residuum after the loss of the oil, the other the same incorporated with water during fusion. The former is sometimes distinguished as *yellow resin* or RESINA FLAVA, the latter *white resin*, or RESINA ALBA. The yellow is more or less translucent, and varies, according to its purity, from a beautiful light amber colour almost to black; the white is opaque, and whitish or yellowish-white, owing to the mechanical intermingling of water. By time and exposure, the white resin gradually loses the water, and reverts to its orignal colour and translucency. So far as concerns our present purpose, it is sufficient to know, in regard to resin, that it has a feeble terebinthinate odour and taste, is insoluble in water, but soluble in alcohol, ether, volatile and fixed oils, and alkaline solutions, softens with a moderate heat and then becomes adhesive, melts at 276° Fahr., is decomposed at a red heat, and is inflammable. It readily unites with wax and fatty matter, when both are brought to the liquid state.

Medical Effect and Uses. Resin is never used internally. Externally it is slightly irritant, and often excites inflammation in a very delicate skin. It is used exclusively in medicine as an ingredient of plasters, cerates, and ointments, in which it serves the three purposes of contributing to the preservation of the fatty matter, imparting adhesiveness, and rendering the preparation slightly irritant. It concerns us here simply as the chief constituent of the resin cerate.

RESIN CERATE.—*Ceratum Resinæ.* U. S., Lond.—*Unguentum Resinæ.* Dub.—*Unguentum Resinosum.* Ed.—*Basilicon Ointment.*—This consists of resin, lard, and yellow wax melted together. Whatever positive dynamic effects it produces, if made of pure materials, may be ascribed to the resin. It is slightly irritant, and is chiefly used as a dressing for blisters, which are to be kept open for a short time. Generally the skin will heal under it, notwithstanding the irritation, to which the parts seem to become accustomed; but it sometimes produces much inflammation, and even causes the blistered surface to suppurate. It is also used as a gentle stimulant to indolent ulcers, and is one of the most efficient applications to chilblains. I know no dressing more efficient in promoting the healing of burns and scalds, when disposed to become indolent. It often occasions pain; but the healing process commences nevertheless, though previously there may have been no tendency towards it. In recent severe burns, it rather relieves than promotes pain; and is much used, in connexion with oil of turpentine, in the form of a liniment, which is officinal.

Liniment of Turpentine (LINIMENTUM TEREBINTHINÆ, *U.S., Dub.*) is prepared by adding half a pint of oil of turpentine to a pound of resin cerate, previously melted. It is commonly known as *Kentish's ointment*, having been originally proposed by Dr. Kentish, as an application to recent burns and scalds. Being of a semi-liquid consistence, it is most conveniently applied by means of linen cloths saturated with it. Care should be taken to confine the application strictly to the injured parts. It relieves the burning pain, and produces a disposition to heal; but should be removed, when, the peculiar inflammation of the burn having ceased, the preparation itself may become irritant.

There are many other vegetable substances, occasionally used externally for their rubefacient effect, most of which, along with this special application of them, have been treated of under other heads.

AROMATICS, and their VOLATILE OILS. All of these have more or less of the rubefacient property, and not a few of them are habitually used. Thus, *powdered ginger*, *cloves*, *cinnamon*, and *black pepper* are frequently made into cataplasms. A good *aromatic cataplasm*, or *spiced plaster* as the preparation is usually called, may be prepared by mixing an ounce of each of the above aromatic powders, half a fluidounce of one of the aromatic tinctures, and sufficient

honey to give the due consistence. This may be applied to the epigastrium in cases of vomiting, spasm of the stomach, and gastrodynia, and over the abdomen in colic; and is especially adapted to these affections in children. The *fresh aromatic herbs*, such as the *mints*, *origanum* or *rosemary*, and *monarda* or *horsemint*, may be used under similar circumstances, being thoroughly bruised, and thus made into a cataplasm. Rubefacient liniments may be prepared from the *volatile oils of rosemary*, *origanum*, &c., mixed in various proportions with almond or olive oil, or from their *alcoholic solutions*, which may be used, especially in connexion with anodynes, as opium, camphor, &c., in rheumatic and neuralgic pains, bruises, and sprains. But these applications have been already incidentally suggested, under the several articles described.

Gum-Resins.—The stimulating gum-resins, as *assafetida*, *ammoniac*, *galbanum*, and *sagapenum*, constitute another category of gentle rubefacients, generally used in the form of plaster, and applied in chronic pains and swellings of the joints, scrofulous tumours, and other chronic tumefactions, occasionally with decided effect in promoting absorption. Officinal preparations of these substances, for the purposes mentioned, are the *Assafetida Plaster* (Emplastrum Assafœtidæ, *U. S.*), the *Ammoniac Plaster* (Emplastrum Ammoniaci, *U. S.*), and *Compound Galbanum Plaster* (Emplastrum Galbani Compositum, *U. S.*), the last of which, besides galbanum, contains turpentine, and Burgundy pitch.

Acids.—Still another category of rubefacients consists of various acrid substances, used commonly for different purposes internally, but applied also locally for their irritant effect. The most prominent of these are *savine* and *mezereon*. These are most frequently employed externally as dressings to blistered surfaces, in order to keep them discharging, which they do effectually, if possessed of all their original powers; but, as found in the shops, they have often become so much deteriorated that they not unfrequently fail. They are used in the form of cerates or ointments, which are officinal. *Savine Cerate* (Ceratum Sabinæ, *U. S.*; Unguentum Sabinæ, *Lond.*, *Dub.*) is made by incorporating two ounces of powdered savine with a pound of resin cerate; *Mezereon Ointment* (Unguentum Mezerei, *U. S.*) by digesting bruised mezereon with lard and wax, till its active properties are extracted.

Alcohol, Ether, and Chloroform are also locally irritant, and are often employed, especially the first two, with a view to a rubefacient impression on the surface. Alcohol is generally applied

by friction, in the form of heated brandy. Ether, when used for this purpose, must be prevented from evaporating; as otherwise it would produce the opposite effect of refrigeration by its volatilization. All these substances, though treated of elsewhere, are mentioned here, in order that the reader may have presented to him the whole class of rubefacients in one view.

THE RANUNCULI.—Different species of *Ranunculus* possess acrid properties, which render them applicable to the purposes of the rubefacients and epispastics. One of them, the *R. bulbosus*, has been retained in the secondary list of the U. S. Pharmacopœia; but all the more acrid species may be used. They are commonly known by the name of *butter-cup*, from the character of their handsome yellow flowers. Both the herb and bulb or cormus may be employed. They must be used fresh, as they lose their virtues by drying. Their acrimony is also dissipated at a boiling temperature. Internally, they violently irritate the stomach, and may even prove fatal. Bruised and applied to the skin, they often excite severe inflammation, and sometimes vesication; but there is great difference of susceptibility to their influence in different individuals; some being little affected, while others are acted on with unexpected violence. Sometimes deep ulcers are produced in the latter individuals. These are not, therefore, medicines for common use; but every physician practising in the country, should be acquainted with their properties; as circumstances may occur in which it may be important that he should avail himself of them.

COMMON NETTLE.—Another plant occasionally used advantageously as a rubefacient is the *common nettle*, or *Urtica dioica*, an herbaceous perennial, indigenous in Europe, but naturalized in the United States. The sharp hairs of the plant, when the herb is applied to the skin, especially when struck upon it with some force, produce a severe irritation, attended with hard whitish elevations, or wheals, very much resembling the eruption denominated urticaria, or nettle-rash, which received its name from this very resemblance. The remedy may sometimes be usefully employed in cutaneous torpor or paralysis, and is peculiarly applicable to cases of retrocession of cutaneous eruptions. I have seen it used, with apparent benefit, in rousing a patient, torpid from the effects of a poisonous dose of opium. Under such circumstances, it aids other measures, in sustaining a certain amount of excitability in the cerebral centres, favourable to the operation of emetics.

IV. AMMONIACAL RUBEFACIENTS.

I. SOLUTION OF AMMONIA.—LIQUOR AMMONIÆ. *U. S.*, *Lond.*, *Dub.*—AMMONIÆ AQUÆ. *Ed.*

THIS is prepared by receiving into a certain measure of water contained in a bottle, the gaseous ammonia proceeding from a mixture of fixed quantities of muriate of ammonia and lime, exposed to heat. The muriatic acid reacts with the lime, forming chloride of calcium and water, and the ammonia passes over with the aqueous vapour, and is condensed in the water of the bottle. The solution thus obtained being too strong, distilled water is added so as to render its sp. gr. 0.960. It may also be prepared from the *stronger solution of ammonia* (see *page* 734) by simply diluting it with distilled water as above.

This preparation, when pure, is a solution of ammonia in water, but is apt to contain some carbonate, the presence of which may be known by the production of a precipitate on the addition of lime-water. It is colourless, of a very pungent smell, and an exceedingly acrid, burning, alkaline taste; but it could not be borne in the mouth without dilution.

We are to consider the preparation here simply as a rubefacient. Applied undiluted to the skin, it produces inflammation with redness, which, with a sufficient continuance of the application, would advance to vesication, and even to gangrene. The solution is, therefore, scarcely ever used in this state; but generally in combination with fixed oil, which not only dilutes it, but modifies its stimulant properties, by combining with it to form a soap.

Liniment of Ammonia, or *Volatile Liniment* (LINIMENTUM AMMONIÆ, *U. S.*, *Lond.*, *Ed.*, *Dub.*) is the form in which ammonia is probably most frequently used with a view to its rubefacient effects. It is prepared by simply shaking together, in a bottle, a mixture of one fluidounce of solution of ammonia and two of olive oil. A thick, yellowish-white liquid is thus obtained, which consists of a soap of ammonia, partly dissolved and partly suspended in water. It is much used in *rheumatic pains*, *inflammation of the throat*, and *catarrhal affections*, especially in children. Should it occasion too much inflammation, it may be further diluted with oil. It may be applied as a lotion, or by moistening with it a piece of flannel to be placed in contact with the skin, and covered so as to prevent, as much as may be, the escape of the gas, which may prove irritant if inhaled.

II. COMPOUND LINIMENT OF AMMONIA.—LINIMENTUM AMMONIÆ COMPOSITUM. *Ed.*

This is an officinal of the Edinburgh College, intended to afford the means of obtaining, at pleasure, a powerful rubefactive, vesicatory, or even caustic effect from ammonia, or a mild rubefaction only. It consists of five measures of stronger solution of ammonia (see *page* 734), two of tincture of camphor, and one of spirit of rosemary. A weaker preparation, directed by the College, is made by adding three parts of tincture of camphor and two of spirit of rosemary. These are mere dilutions of the stronger solution of ammonia; the additions having no other special effect than to modify the odour. The stronger preparation is used for blistering or cauterization (see *page* 735). The weaker may be employed as a powerful and very prompt rubefacient. Even this will also vesicate or cauterize if long applied. But used as a lotion, and withdrawn at the moment that it has sufficiently reddened the skin, it may be used in cases where a very speedy and efficient impression is required; as in violent internal spasms, intense neuralgic pains, or great general prostration. In violent cases of spinal irritation, it may be applied along the spine with advantage.

III. CARBONATE OF AMMONIA.—AMMONIÆ CARBONAS. *U. S., Ed.*—AMMONIÆ SESQUICARBONAS. *Lond., Dub.*

This has been already treated of, in reference to its effects on the system generally (i. 569). As a rubefacient it has considerable energy, and is sometimes though rarely employed; the liquid preparations above mentioned being preferred. It may be mixed with three or four parts of simple ointment or lard, and rubbed upon rheumatic joints; or, incorporated with extract of belladonna, in the proportion of one part to three of the extract, may be applied, by means of suitable dressings, in the pains of rheumatism and neuralgia.

POTASSA.—A solution, containing two drachms of hydrate of potassa in four fluidounces of water, was employed by the late Dr. Hartshorne, of Philadelphia, as a powerful rubefacient, in tetanus, rubbed along the whole length of the spine; care being taken not to produce cauterization. This practice has been imitated by many American physicians.

2. *Pustulating Rubefacients.*

I. TARTRATE OF ANTIMONY AND POTASSA.

ANTIMONII ET POTASSÆ TARTRAS.

Syn. Tartar Emetic.

Local Effects. When tartar emetic, in the state of solution, ointment, or plaster, is kept for some time in contact with the skin, it produces inflammation, with a peculiar and quite characteristic eruption, which gives it, under certain circumstances, great therapeutic value. It operates with much greater facility in some persons than others, with, so far as appears, the same delicacy of cuticle; so that its influence is properly dynamic. In the course of a day or two, some effect is generally sensible. An increased heat is felt in the part, with a prickling sensation, and, on examination, the surface is found reddened, with numerous red papulous spots. With a continuance of the application, there is an increase of uneasiness; and at length the pain becomes so severe as to render the suspension or removal of the antimonial necessary. In the mean time, the pimples have been converted into vesicles or pustules, some of which are small and hemispherical, others are large, from half an inch to an inch in diameter, flat, with a dark crust in the centre, and a surrounding inflamed areola. The contents of the pustules are false membrane, and a sero-purulent liquid. They are very painful.

If the application now cease, the vesicles dry up, and, in the large pustules, the central crust gradually extends till it covers the whole surface, and at length falls off, leaving the skin sound. Sometimes the pustules are only few, at other times numerous. Should the antimonial be continued, the eruption becomes gangrenous, and sloughs are produced, followed by ulcers. In some persons, disposed to ulceration, this condition takes place even from the ordinary pustules. Hence scars are not unfrequently left behind; and a surface, which has been repeatedly subjected to this remedial measure, sometimes looks as though it had been scarred with small-pox. Death is said to have occurred, in a child two years old, from the local effects of tartar emetic; but I have never seen what I should consider even as an approach to danger. If applied to a surface denuded of the cuticle, or to a fresh cut, the medicine acts very promptly, with very severe pain, and much inflammation, which is liable to end in a slough.

Sometimes, though rarely, I have known tartar emetic, applied in this way, to produce so much nausea and vomiting as to forbid its continuance.

Therapeutic Application. Therapeutically, pustulation by tartar emetic is indicated mainly on the principle of revulsion. It is never resorted to in cases requiring a prompt impression, or as a stimulant to the system. But in chronic affections of all kinds, and especially those of an unusually obstinate character, in which revulsion towards the surface is required, the remedy may be employed. It sometimes appears to produce curative effects, which cannot be obtained from blisters. This may result either from the depth of the impression on the skin, calling relations into play which may not exist, in the same degree, between the surface of the skin and interior parts; or from some peculiar influence which a pustular eruption may exercise, different from that of simple diffused inflammation, upon the nervous centres.

It is frequently resorted to in *chronic bronchitis*, *pleuritis*, and *pericarditis*, and sometimes as an application to the shaved scalp in chronic *meningitis*, threatening serious consequences. But the most frequent use of it has been in cases of *spinal irritation*, with great tenderness on pressure upon one or more of the spinous processes, and disorder in the functions supplied with nervous influence from the spinal marrow, as of the stomach, bowels, lungs, and heart. These affections occur most frequently in hysterical women; but they are by no means confined to this class of patients, and occasionally occur in men. Violent dyspnœa, palpitation of the heart, gastric and enteric pain or spasm, and excessive sickness of stomach, are not unfrequent symptoms. These will generally yield promptly to a few cups or leeches, applied near the tender portion of the spinal marrow; but if these fail, or if the affection frequently recur, recourse can be had to tartar emetic; and it will not only often afford temporary relief, but will sometimes effect permanent cures, especially if the effect be long sustained, and the complaint do not depend on disease or malposition of the uterus.

Mode of Application. A saturated solution may be applied, either in the way of lotion, or by means of compresses of linen kept moistened with it. Such a solution may be made by dissolving two scruples of the salt in a fluidounce of boiling water, and allowing the liquid to cool. The ointment is more frequently used.

Antimonial Ointment (UNGUENTUM ANTIMONII, *U.S.*) is prepared, according to the U.S. Pharmacopœia, by thoroughly incorporating

two drachms of tartar emetic with an ounce of lard. The direction is important, first to rub the salt with a little of the lard, and afterwards with the whole. A more uniform mixture is thus prepared. The proportion may be lessened to one or increased to three drachms, according to the degree of effect desired, or the susceptibility of the patient. From half a drachm to a drachm of the ointment may be rubbed thoroughly upon the skin, twice or more frequently in the twenty-four hours; or the ointment may be applied spread on linen; or, what is still more effectual, the two methods may be combined.

A *Tartar Emetic Plaster* may be prepared by sprinkling the salt, very finely powdered, upon the surface of a recently spread Burgundy pitch plaster, so as to cover the surface, yet not prevent its adhesion. It may be pressed gently into the substance of the plaster by a roller. An advantage of this mode of application is that it requires no attention, except merely to watch the effects of the plaster, and to see that it is removed in due time. The slight serous discharge which it excites at the commencement of its action may dissolve the salt, and thus hasten its characteristic effect.

Care should be taken that the part upon which the plaster or any other preparation is applied, should be free from wounds or abrasion. For example, after cupping or leeching, time, as a general rule, should be allowed for the wounds to heal. In cases, however, of great emergency, this caution may be overlooked for the sake of a prompt effect; but the patient should be watched carefully, in order to prevent sloughing.

II. CROTON OIL.

OLEUM TIGLII.

For an account of the scource, properties, composition, and cathartic effects of croton oil, see *page* 560. We are here to consider it as an external remedy.

Local Effects. When croton oil is rubbed on the skin, or simply kept in contact with it, after a considerable time, sometimes sooner, sometimes later, but generally in the course of a day or two, it produces a diffused redness of the surface, which is, almost from the beginning, attended with a countless crop of minute eczematous vesicles. These increase, become pustular, run together, and at

length, if the application be continued, form one complete pustulated surface, with considerable swelling. Upon a cessation of the application, the inflammation abates, and the pustules soon form crusts, which after a time fall off, leaving the surface somewhat discoloured, but not otherwise deranged. But the difference of susceptibility to the effects of croton oil is very remarkable, and much more striking even than in the case of tartar emetic. I have seen persons, whose skins I could scarcely affect with the oil by the most diligent efforts; and I have repeatedly seen others, in which it has acted with extraordinary violence, causing intense inflammation in the seat of application, and sometimes even far beyond it. In several instances, I have seen the face and eyes violently inflamed from croton oil rubbed on the back; and, though it is probable that the fingers of the patient may have conveyed it from one point to the other, I have been unable to trace the connexion.

Therapeutic Application. The oil may be used as a revulsive agent, whenever the case is so far chronic in its character as to admit of a slow operation in the remedial agent. Several days must be allowed for the production of the full effect of the oil. It is generally used in chronic internal inflammations, particularly the pectoral, in rheumatic and scrofulous swellings, and in other indolent tumefactions. The particular affection in which I have derived most advantage from it is chronic laryngitis, in which, if properly applied, it is probably as effectual as tartar emetic or repeated blistering, and on the whole more convenient.

Croton oil would seem to be strongly indicated in cases of internal disease, which have followed the disappearance of an eruption upon the surface. There may be peculiar relations between eruptive cutaneous affections and the constitution generally, differing from those of simple diffused inflammation; and it is, therefore, not impossible that disorder, resulting from or connected with the disappearance of an eruption, may be relieved by the artificial production of another eruption, where the inflammation of a simple rubefacient or blister might fail. Upon the same principle, the oil may be used in internal irritations which may be supposed to depend upon constitutional causes, ordinarily giving rise to a cutaneous eruption. Thus, patients sometimes complain of great gastric uneasiness, and various internal distress, perhaps dyspnœa, perhaps cardiac disturbance, which have come rather suddenly upon them, and for which they cannot account. At length an eruption occurs, urticaria for example, and they are completely relieved of their in-

ternal sufferings. Where symptoms of this kind, of some duration, suggest to the practitioner such a connexion with an eruptive tendency, there is a fair indication for the use of croton oil. It is preferable to tartar emetic, for meeting this indication, because less severe, and because it can be extended over a wider surface, and thus bring a greater degree of this particular eruptive influence into operation. The proper place for applying the oil, if there has been an eruption, would be its former seat; if none, the outside of the arm above the elbow.

Method of Application. It is always proper, when the peculiar susceptibilities of the patient are not known, to begin with a mixture of one part of the croton oil with four parts of olive or almond oil. If this should not act, the strength may be gradually increased, until, if found necessary, the undiluted oil may be employed. Sometimes the weakest acts energetically, and, in other cases, the strongest scarcely at all. The oil should be applied by friction, once, twice, or three times daily, according to the urgency of the case, and the peculiar susceptibility; and, in the mean time, a piece of flannel saturated with it may be kept in contact with the surface. When the full effect has been produced, the oil must be suspended; but, in order to sustain its influence, and it often ought to be sustained for months, the oil must be frequently reapplied. In the intervals, the surface may be dressed with simple cerate, or, if very much irritated, with cold cream (*unguentum aquæ rosæ*).

CLASS III.

ESCHAROTICS.

THESE are agents which, applied to any portion of the body, destroy the life of the part with which they are in contact, and produce a slough.

They operate either *dynamically*, by an influence directly on the vitality of the part, or chemically by decomposing the tissues affected. In the former case, they produce disorganization by first destroying life; in the latter they destroy life by producing disorganization.

They are employed 1. to form issues, 2. to produce superficial ulceration and suppuration, 3. to alter the action of diseased surfaces, by removing a layer of the tissue in which it is seated, 4. to promote the healing of ulcers, by forming a covering impervious to the air, 5. to remove fungous granulations, and other morbid growths, as carcinomatous tumours, &c., 6. to open abscesses, and 7. to decompose and render inert the noxious matter in poisoned wounds.

Of these effects, all but the first two are local. But the production of issues and superficial suppurating surfaces, has for its aim certain favourable influences on the system, or on parts distinct from the one affected, which require notice in this place. The consideration of the local effects will fall most conveniently under the several agents producing them.

Issues. These are running sores, made either by the knife or caustic substances, and afterwards kept open, generally by means of small round bodies called issue peas. In forming them, an incision is made through the skin, into which a pledget of lint is first introduced, and afterwards, when suppuration has been established, the little bodies referred to. The mode in which issues are produced by caustic agents, will be described along with the agents themselves. *Setons*, which consist of a slender skein of silk threads, passed by means of a needle through the cellular tissue beneath the skin, and allowed to remain so as to keep up a suppurative

discharge, act precisely on the same principles as issues. So also do the *superficial suppurating surfaces* just alluded to, as one of the effects of escharotics.

Principles on which Issues Operate. These various agencies correspond with the epispastics in two of their principles of therapeutic action; those, namely, of revulsion and depletion. The other purposes of that class of medicines, they are in general calculated to fulfil but imperfectly, if at all. As revulsive agents, however, they have considerable power, and, though less energetic than blisters for a short period, have the advantage of a long continued and steady impression, which renders them sometimes even more effective in very chronic cases. As depleting remedies, they are also, in the long run, more effectual than blisters, unless these are made to imitate issues by being kept steadily suppurating; because the amount of organic matter in pus is vastly greater than in simple serous effusion.

Therapeutic Application of Issues. The most important use of issues is in the cure of obstinate chronic inflammation. It is in scrofulous affections of this kind, that they are employed most commonly, and with greatest relative success; and especially in disease of the spinal column, threatening lumbar or psoas abscess. But they may be used also in chronic inflammation of the larger joints, in pectoral inflammations of obstinate character, in chronic meningitis and cerebritis; and, indeed, in all cases of this nature, wherever seated, when the affection is of limited extent, and feeble in its grade of action, but extremely persistent.

Another purpose which issues are calculated to fulfil, is to serve as a point of afflux, or as a drain for morbid tendencies, in certain cases of constitutional disorder, in which there is a disposition to serious or very troublesome local irritation, whether internal or external, as in gouty, rheumatic, scrofulous, and eruptive diseases. They may thus ward off, or alleviate an anticipated and customary attack.

A third application of issues is to cases in which it is deemed advisable to check some long continued and habitual discharge, as the hemorrhoidal flux for example, or to heal some old and extensive ulcer to which the system may have become accustomed, or to similar cases in which such discharges have already been arrested, or such ulcers closed. The object of the issue is here obviously the same as in the preceding application of the remedy; namely, to serve as a local point of afflux, or a drain for the morbid tendencies

or accumulated blood, which may result from the cessation of the habitual disease.

The position of the issue must of course be regulated by the seat of the disease, and the special object aimed at. Generally speaking, in cases of chronic inflammation, it should be established as near the seat of the affection as possible. Thus, in disease of the spine, an issue should be made on each side of the column; in obstinate sciatica, behind the large trochanter; in affections of the chest, on parts of the breast or back correponding with them; and, in meningeal disease, either on the scalp, or at the nape of the neck, as the seat of the disorder may be in the upper part of the brain, or at its base. But when the object is to affect the system generally, and serve as an outlet for morbid tendencies, the issue should be made upon the extremities; either on the arm below the insertion of the deltoid, on the inside of the thigh some inches above the inner condyle, or on the upper and inner part of the leg.

HEAT AS AN ESCHAROTIC.

Heat, in a certain degree of intensity and duration, destroys the life of the part on which it acts. When it produces this effect directly, as it almost always does, it operates by altering the chemical affinities of the constituents of the tissue, and disposing them to form new combinations. The force of the affinities previously in operation, and the vital resistance are at once overcome, and decomposition takes place, with a consequent loss of life in the part.

But heat may also operate dynamically as an escharotic. Without immediately destroying life, it may produce an amount of inflammation greater than the vitality of the part can withstand; and gangrene follows as a direct result of the inflammation, and a secondary effect of the heat. It is never, however, practically employed with this intention. The effect is always uncertain; and the operation would be much more painful than that which aims at the immediate death of the part; as sensibility is lost with life, and the pain soon ceases. Indeed, under the operation of an exceedingly intense heat, pain is sometimes scarcely felt. A workman in a furnace, in lading out melted iron, slipped, and allowed the contents of the ladle to fall into his shoe. The liquid metal surrounded his foot, and formed a sort of casing about it. Nevertheless, without appearing to suffer greatly, he walked unaided to his house, at a considerable distance. The whole surface of the foot was of course charred; but the action had been so instantaneous and intense, that sensibility was lost almost before there had been time for sensation.

Many different modes of applying heat, with a view to its escharotic effect, have been employed; but only two have held their ground, and continue in use at present; namely, by the actual cautery and by moxa.

1. THE ACTUAL CAUTERY. This term is applied to a metallic body, heated sufficiently to enable it to destroy the life of the part with which it may be brought into contact. Iron or steel is usually employed. The metallic instrument used is of various forms; but consists generally of a long stem, which serves for a handle, and of a thicker terminal expansion, which is the part heated. The latter is of different shapes to meet special purposes, conical with the point truncated, flat and circular or oval, hexagonal, &c. It may be heated to the temperature of boiling water, to dull redness, to full redness, or to whiteness or incandescence.

The actual cautery has been used for most, if not for all the purposes of escharotics in general, and for some to which the other articles of the class are less applicable or quite inadequate; as for arresting hemorrhage in parts where the ligature cannot be applied, and ordinary styptics have proved unavailing, for cauterizing indolent carious ulcers in deep-lying bones, and for destroying tumours in parts inaccessible to the knife, as in the antrum. It has also been particularly recommended in callous fistulous sores, and poisoned wounds. Even in the formation of issues and ulcerated surfaces, its advocates claim for it a superiority over the caustic potassa, on the grounds that its pain, though severe for an instant, is of shorter duration, that the slough separates more speedily, leaving a stronger disposition to copious suppuration behind it, and that, as it destroys the parts which it touches, and only these, it is easier to regulate the precise limits of the escharotic effect. The heat radiating through the surrounding tissues sets up in them an inflammatory excitement, which both produces the local effects just referred to, and brings the system into a sympathy, which may sometimes be beneficial.

For producing a considerable or deep slough, the instrument should be at a white heat or incandescent, should be applied with some force to the part, and should not be allowed to remain in contact with it longer than 7 or 8 seconds at furthest. Should more effect than is thus produced be required, the first instrument should be immediately followed by a second, and this sometimes by a third. To protect the neighbouring parts, they may be covered by a thick compress or piece of pasteboard, previously steeped in

a solution of common salt. It is generally advisable to make an incision in the skin with a bistoury, before the application of the instrument, in order to produce a deeper impression. (*Marjolin et Ollivier*, Dict. de Med., vii. 53.)

In producing mere superficial ulcers, the truncated point or edge of the instrument, now only at full redness, may be drawn rapidly and lightly in parallel lines over the surface; and the same operation may be repeated, if the first effect should not be sufficient. Inflammation with swelling occurs, the sloughs spread and separate, profuse suppuration takes place, and the parts heal in two or three weeks, leaving slight cicatrices, which are ultimately nearly obliterated. This remedy has been strongly recommended in obstinate chronic inflammation of the larger joints, of a rheumatic or scrofulous character, in cases of chronic synovitis, and in neuralgic affections. (*Ibid.*)

Another method of superficial cauterization is by means of metallic plates, of a size corresponding with the extent of effect desired, which are introduced for five minutes into boiling water, or salt water which boils at a higher temperature, and, having thus acquired the heat of the liquid, are applied with pressure to the surface for a period of about ten seconds. This time is usually sufficient to secure a superficial slough. The same instrument may be used for vesicating, by covering the surface with a piece of dry silk, previously to the application of the heated plate. Rubefaction is thus produced, which is in a short time followed by a blister. If it be desired simply to redden without vesicating, the period of application must be only momentary.

2. MOXA.

This name is given to small bodies composed of very combustible matter, which are burned in contact with the skin. The remedy has been in use from time immemorial in China and Japan, whence it was carried to Europe by the Portuguese. Brought into extraordinary credit, some years since, by the countenance of Larrey and others, it has since declined much in popularity, and is now, I believe, comparatively little used, though no doubt susceptible of occasional beneficial application.

Moxa is in the form of cones or cylinders, which are made of various material. Perhaps the kind most used consists of cylinders of cotton impregnated with nitre, and inclosed in linen or silk. The advantage of this substance is that, after having been set on fire, it will continue to burn spontaneously, without the necessity

of being blown upon, by a pair of bellows or otherwise, to support the combustion. For the precise mode of preparing this and other forms of moxa, the reader is referred to the Appendix of the U. S. Dispensatory.

Moxa may be so used as to produce either a rubefacient, vesicatory, or escharotic effect, according to the extent to which the combustion is permitted to proceed, and acts therapeutically upon the same principles as those which govern these several classes respectively. It is, however, generally used so as to form an eschar. The complaints in which it has been most employed are obstinate neuralgia; chronic inflammation of the spine and hip, and other obstinate scrofulous and rheumatic affections; paralytic diseases, as amaurosis, deafness, loss of taste, muscular palsy, &c.; and chronic internal inflammations, as of the bronchia, pleura, liver, and spleen. But it may be employed whenever a strong and sustained revulsive impression is indicated, and no danger exists of local injury from the application. Wherever the skin has beneath it little cellular or adipose tissue, and lies immediately over bone, tendons, or cartilage, it should be avoided; as over the cranium where protected only by the periosteum and skin; the eyelids, nose, and ears; the larynx and trachea; the spinous processes of the vertebræ; the projecting parts of joints; or near the tendons of the wrist, ankle, hands, and feet. It should not be applied over the mamma or testicle, along the spermatic cord, or in positions in which it might endanger an opening into the joints.

The cylinder used may be from half an inch to an inch in diameter, and at most an inch high. One end of it being set on fire, the other is placed on the skin, and held there by means of a pair of forceps or otherwise. In order to avoid injury of surrounding parts, they may be covered with moistened pasteboard or a compress of linen, with a hole cut in the centre so as to fit the cylinder. If necessary, the combustion may be supported by blowing on it with the breath through a tube, or by a pair of bellows.

The sensation excited by it differs from that of the red hot or incandescent iron, in being slight at first, and gradually increasing in intensity, till it becomes exceedingly severe; while, from the latter cause, it is severest at first and gradually declines. If a rubefacient impression only is desired, the moxa may be allowed to burn for a short time only; if a full effect, to burn till it is consumed. The extent and depth of the eschar will of course be proportionate to the size of the cylinder, and the amount and nature of the material

contained in it. The skin beneath the moxa is left yellowish, dry and hard, with an areola of redness around it, which, however, soon disappears. Several days usually elapse before the eschar begins to be detached. Its beneficial effects depend mainly on the suppuration of the resulting ulcer, which, if thought desirable, may be kept up by issue peas.

I. POTASSA. *U.S., Ed.*

POTASSÆ HYDRAS. *Lond.*—POTASSA CAUSTICA. *Dub.*

Syn. Common Caustic.—Caustic Potassa.

Preparation and Properties.—For use as an escharotic, potassa is prepared by evaporating the officinal *Solution of Potassa* (LIQUOR POTASSÆ, *U.S.*) until it ceases to boil, and then pouring it into moulds to concrete. It is in cylindrical sticks, somewhat thicker than a quill, and several inches long, usually of a grayish colour, sometimes of a bluish or brownish tint, and occasionally white, when prepared out of very pure materials. On exposure to the air, it attracts moisture and carbonic acid, and rapidly deliquesces; and must, therefore, be kept in well-stopped bottles. It is soluble, with the exception of impurities, in less than its own weight of water; and is also readily dissolved by alcohol. The impurities are usually lime and oxide of iron, which are left behind by water, and carbonate of potassa, which is not taken up by alcohol. These, however, in any amount in which they are ordinarily found, do not materially impair the efficiency of the caustic. Caustic potassa is a hydrate of the pure alkali, consisting of one equivalent of pure potassa, with one equivalent of water, of which it cannot be deprived by heat.

Effects. When caustic potassa is placed in contact with the skin, it gradually liquefies, and soon destroys the life of the part, the colour of which is changed to a dirty grayish hue. Its action is accompanied first with a sensation of warmth, which rapidly increases to a severe burning pain, more durable than that produced by the actual cautery, and diminishing only when the life of the part is lost. Inflammation is excited in the adjoining tissues, ulceration takes place with suppuration, and the dead part, which begins to be detached in five or six days, is at length separated, at a period of time varying from two to four weeks, according to the energy of the inflammatory process. The action of potassa is deeper than

that of most other caustic substances, extending through the skin, and, sometimes, if in large quantity, to a considerable depth beneath it. The effect is produced by a union between the potassa and the substance of the tissues; and, as the compounds thus formed are more or less soluble, no barrier is presented to the further penetration of the caustic, until it is wholly expended in combination. This depth of action is the characteristic advantage of potassa as a caustic.

Uses. Caustic potassa is preferred for the formation of issues, and may be used for the opening of abscesses, the decomposition of poison in wounds, and the removal of diseased structure, in fact, whenever it is desirable to destroy any considerable portion of tissue by escharotic measures; but for these latter purposes, the knife is now almost always employed.

Application. For preparing issues, potassa is applied in different methods. One is to cover the skin with a piece of adhesive plaster, having in its centre a circular or oval opening, of the size of the proposed issue. A small piece of the caustic, from one to two lines in diameter, or more than one piece, when a large issue is wanted, are placed upon the exposed skin, and covered with another piece of adhesive plaster, and the whole secured by a compress. On the removal of the dressings at the end of four or five hours, a black moist eschar is seen, surrounded with a border of inflammation. Another, and probably preferable method, is, after having applied the first adhesive plaster as above directed, to moisten the end of a stick of caustic, and rub it upon the uncovered space in the centre, until the whole surface becomes discoloured. Dressings of resin cerate may be applied until the slough separates, or emollient poultices if there is much inflammation. To hasten the separation, a crucial incision is sometimes made through the eschar. To keep open the issue, it is customary to insert rounded bodies, called issue peas, most of which, from their porosity, absorb the liquids, and thus swell considerably. For this purpose dried peas may be used, or spherical pieces of orris root of the same size, or those minute bodies made from small unripe oranges. The two latter variety of issue peas have the advantages of an agreeable odour, and slight irritant properties. It will be found convenient to pass a thread through the centre of each pea, by which it can be withdrawn when deemed proper. If it be desired to render these little bodies more irritant, they may be covered with some stimulating ointment, as that of

mezereon. The issue may be dressed with resin plaster. I have seen used as a substitute for the peas, a thick piece of sole-leather, cut upon one of its surfaces into little quadrangular pyramids, the points of which were made to press upon the ulcer, by applying to its surface the cut side of the leather.

It has been stated above that, for other purposes than the formation of issues, and, among them, for the opening of abscesses, the knife is almost always preferred. There is one condition, however, in which potassa is habitually resorted to by some surgeons. I refer to abscesses of the liver, which it may be important to open, but in relation to which, there may be a fear that the peritoneal surfaces may not have contracted adhesions, and that an incision might be followed by an escape of pus into the abdominal cavity. By removing with caustic potassa, carefully applied, successive portions of the tissue intervening between the cuticle and the peritoneal membrane, it is supposed that inflammation may be excited in that membrane, sufficient to lead to the desired adhesion, after the formation of which the lancet may be used with safety.

POTASSA WITH LIME.—POTASSA CUM CALCE. *U.S., Lond., Ed.* POTASSA CAUSTICA CUM CALCE. *Dub.*—*Weaker Common Caustic.*—*Vienna Caustic.*

This is nothing more than hydrate of potassa, rendered milder by incorporation with an equal weight of lime. The U.S. Pharmacopœia merely orders the two ingredients to be rubbed together. It is in the form of a powder, which may be kept for use in bottles. In Vienna, where it was introduced into use, it is prepared with six parts of quicklime and five of caustic potassa. (*Dict. de Med.*, vii. 37.) By the use of this preparation, greater precision is said to be given to the outline of the eschar; as the alkali is not so much disposed to diffuse itself. When used, it is made into a paste with a little alcohol, and applied to a surface surrounded with adhesive plaster, as in the case of the stronger caustic. In five or six minutes the whole depth of the skin is usually cauterized; and, if it be allowed to remain from ten to twenty minutes, the effect extends to the underlying cellular tissue. On removing the caustic, the surface should be washed with vinegar to neutralize any remaining alkali; and the same caution should be observed when the stronger caustic is used. The issue is to be treated as if made in the method before described.

II. NITRATE OF SILVER.

ARGENTI NITRAS FUSUS. *U.S., Dub.*—ARGENTI NITRAS. *Lond., Ed.*

Syn. Lunar Caustic.

Preparation and Properties. Nitrate of silver, for escharotic purposes, is prepared simply by melting the dry nitrate (i. 389) in a crucible, continuing the heat till ebullition ceases, and then pouring the liquid into moulds, where it is allowed to harden. It is in the form of cylindrical sticks, about as thick as a quill, and several inches long, which are usually kept wrapped closely in paper, sealed at the ends. These sticks are hard and brittle, with a crystalline radiated fracture, and at first of a white colour, which, on exposure, gradually changes to gray, and ultimately becomes nearly black. The chemical properties of the fused nitrate are the same as those of the crystallized (i. 389). It almost always contains impurities, some added fraudulently, as nitrate of potassa, others resulting from impurities in the silver employed in its preparation, as the nitrates of copper and lead. For a more particular account of these impurities, and for the modes of detecting them, see the article *Argenti Nitras Fusus* in the U. S. Dispensatory. As the preparation is found in the shops, it seldom fails to produce the desired effect. A good method for keeping the sticks is, as recommended by M. Dumeril, to coat them with wax, which, at the same time that it excludes the air and light, gives greater strength to them, and protects the fingers of the operator. When the application is to be made, the wax is simply scraped off from one end of the stick, where it is brought to a point.

Effects. We have here to consider only the topical effects of the lunar caustic, as applied to the surface, or parts within reach from without. Like all the other escharotic medicines of this class, it may be so used, by varying its strength, as to be either simply excitant, epispastic, or escharotic; and, both for the first and last of these effects, it is very much used. Applied to the cuticle, it soon blackens it, probably through the partial deoxidation of the oxide of silver; but, on a mucous membrane, the skin destitute of epidermis, or the surface of an ulcer, it produces a pure white streak wherever it passes, owing chiefly to its union with the albuminous matter, but in part probably to its reaction with the chloride of sodium of the secreted liquids or the tissues, resulting in the formation of chloride of

silver. These compounds, however, darken on exposure; and hence the surfaces, at first white, blacken if acted on by the light. Neither the blackening of the cuticle, nor the whitening of the moist surfaces, necessarily imply a caustic effect; as they are often produced by the salt too much diluted to affect the organization of the tissues. The stain of the cuticle only disappears with its ultimate exfoliation, that of the mucous surfaces gradually passes off with the altered secretion, or the separation of the epithelium, if that has been involved.

When the dry nitrate is applied to the sound skin, also dry, little effect is produced; but a saturated solution, or the moistened stick, soon excites a smarting sensation, and, if continued, causes destruction of the cuticle, and superficial cauterization of the true skin. If the application be not continued long enough to destroy the cuticle, it often happens that, at the end of some hours, vesication takes place, which is usually less painful than a blister produced by cantharides. A similar application to a mucous membrane, or a denuded surface, immediately causes a superficial eschar. When vesication has taken place in the skin, the blackened cuticle breaks, and falls off in a short time, leaving a sound surface. When an eschar is produced, it separates in a few days, and not unfrequently, in the case of mucous or unprotected surfaces, in less than a day, when the effect has been very slight. The pain attendant on the escharotic operation is considerable, sometimes severe, but much less than that of caustic potassa; and in some surfaces it is scarcely felt. It differs very much with the susceptibility of the surface. Thus, in the conjunctiva the pain is often exquisitely severe; while in the vagina, and at the os uteri, the application may produce little or no disagreeable sensation.

Nitrate of silver operates as a caustic by its affinity for the constituents of the tissues, especially their albumen and fibrin, with which it forms insoluble compounds. These, in consequence of their insolubility, cannot be penetrated by the dissolved nitrate, and consequently protect the parts beneath from the uncombined portion of the salt. Hence, the escharotic operation of lunar caustic is always superficial, and it is almost impossible to make it act to a great depth. In this respect it differs entirely from the caustic potassa; and the peculiarity constitutes its great recommendation. Without this property, it would be inapplicable to most of the important purposes for which it is used.

In the parts with which it may be in contact, without destroying them, the salt produces, along with its excitant effect, contraction of the tissues, or, in other words, acts as an astringent; and this property also constitutes one of its therapeutic recommendations.

Therapeutic Uses. Nitrate of silver is one of the most valuable, if not the most valuable, of topical remedies; being used in a great number of affections, and with the happiest results. I shall treat first of its employment purely as an escharotic, and afterwards of those applications of it, which, though they may be connected with its caustic operation, depend also on other influences for their curative effect.

1. *As a Caustic purely.* In this capacity, its application is not extensive. It is unfit for the formation of issues, the opening of abscesses, or the removal of any considerable portion of structure, whether diseased or normal. It may, however, be used for the *destruction of warts*, and *small excrescences*, whether venereal or otherwise, and for that of *fungous granulations;* in all of which, however, its escharotic property depends probably as much upon the over-excitation it produces, as upon its chemically decomposing effect. In *strictures* it is sometimes beneficially used. In old and obstinate *strictures of the urethra* it has been much resorted to, though by some surgeons considered unnecessary. *Strictures of the œsophagus and rectum* are said also to have been beneficially treated by means of it. In these cases, care is taken, by suitably contrived instruments, to confine the operation of the caustic to the part affected. It is much safer than potassa, in consequence of the limited extent of its action. In those *poisoned wounds*, where only a superficial effect is wanted, nitrate of silver is usually preferred, especially in *dissecting wounds.*

2. *As a Caustic, Alterative, &c., jointly.* The number of affections in which nitrate of silver is employed, with these complex objects, is very large. They are, however, generally ulcerous in their character. When the caustic is applied over the whole of an ulcerated surface, it produces a white crust, which, if the ulcer is small, gradually darkens, hardens, and contracts, forming a sort of scab to the diseased surface, which heals under its protecting influence, and, when it falls off, has generally become covered with a new cuticle. When this does not happen, ulcerated surfaces, whether specific, as in syphilis, or simply obstinate through habit, indolence, or debility, are often rapidly benefited by successive applications of this agent, and speedily get well after

long fruitless efforts with other means. How does the remedy operate in these cases? Probably on several different principles.

In the *first place*, through its caustic operation, it removes portions of the diseased surface, and often probably the whole of that in which any special or specific morbid action resides, leaving, after the separation of the superficial slough, only a healthy ulceration, disposed, like that of a recent wound, to heal. Perhaps, even in many simply indolent ulcers, it is only a slight depth of tissue in which the feebleness and indolence reside. The caustic operation, moreover, proves useful in removing the callous edges of ulcers, which, wholly incapable of due action themselves, serve as foreign bodies to prevent healing, and keep up irritation in the parts beneath them. Such a surface, of almost cartilaginous character, sometimes lines old fistulous sores, the continuance of which is wholly incompatible with the healing process.

Secondly, the salt operates by its excitant property, which rouses debilitated surfaces to healthy activity, and often proves useful, even though no escharotic effect has been produced.

Thirdly, the astringent action of the nitrate must often prove serviceable in relaxed, flabby, and fungous ulcers.

Fourthly, we may say of this remedy, as of many others, that it is capable of exercising an alterative or substitutive influence upon diseased structure, either directly changing the nature of the existing action into a healthy one, or replacing that existing by its own more energetic operation, which, ceasing after a time, leaves the parts in the normal condition, and therefore disposed to heal.

Fifthly, I believe that there is yet another, and probably still more efficient, agency by which the curative effects in these cases are produced. I mean a *protective influence*, by which, through the impenetrable coating which the escharotic gives to the diseased surface, it protects it against the injurious influence of atmospheric air, and other causes of irritation from without. I shall have occasion to treat more fully of this agency under the class of medicines which I designate as *protectives*, when I hope to show that this is a highly important therapeutic influence, susceptible of extensive application in the cure of inflammatory and irritative diseases.

By one or more, or all of the above modes of action, nitrate of silver is rendered, probably beyond all other agents, effective in the cure of ulcers.

It is unnecessary to treat of the several forms of ulceration in which it may be used with advantage. It may be said, as a general

rule, that it may be tried, with good hope of cure, in all which refuse to heal under mild applications, and which are not sustained by some constitutional disorder, or inherent vice of their nature, as the cancerous ulcers, for example. Even in the latter classes, it may still be employed as a palliative, and in some cases, though it will not remove the constitutional affection, may cure the existing local disease.

Among the ulcers to which the remedy is peculiarly applicable, may be mentioned the primary *syphilitic chancre*, *obstinate ulcers in the mouth and fauces*, *gangræna oris*, *scrofulous ulcers of the cornea and conjunctiva*, *lupus*, and generally all *chronic*, *indolent*, or *flabby ulcers*, *with callous edges*, *fungous growths*, &c. Even *inflamed* or *irritable ulcers* will often yield to this remedy duly applied; and this leads us to another application of nitrate of silver, perhaps not less important than that just noticed.

3. *As an Antiphlogistic Agent.* Upon the same protective principle above alluded to, nitrate of silver operates powerfully as an antiphlogistic remedy. It is to Mr. Higginbottom that is mainly due the great extension given to this application of the remedy. In all kinds of superficial inflammation, whether of the mucous membranes or the skin, whether acute or chronic, whether of the ordinary character or specific, if the nitrate of silver can be brought to bear with full force upon the diseased part, some favourable influence may be hoped for, and very frequently a cure effected. Even when the inflammation is seated beneath the two tissues referred to, but without the great cavities, more or less of an antiphlogistic effect is often exerted. Though, as I believe, the result is mainly dependent on the protective principle, there are probably other modes in which the remedy operates. Sometimes it may act beneficially as an astringent, causing the congested vessels to contract, and thus diminishing the supply of blood. In the advanced stages, it may not only operate advantageously in this way, but also by a simple excitant effect upon the enfeebled and relaxed tissue. Again, it probably acts in some cases as an alterative or supersedent remedy, especially in those inflammations which are of a specific character.

But, though thus generally effective, the remedy will not always succeed, and, if it fail, may sometimes do harm by its excitant influence in acute cases. When the local affection is the result of the general state of the system, when it is complicated with fever and plethora, and especially in the highest state of inflammatory

excitement, the nitrate of silver will often fail. Nor, as a general rule, should it be applied under these circumstances. The cases to which it is best adapted are *superficial chronic inflammation* in general, acute *inflammation of the diphtheritic* or *pseudomembranous character*, and the *declining stage* or *suppurative condition* in other cases, when nature seems inadequate to a cure. Sometimes, also, it proves effectual in the very forming stage of ordinary inflammation, while the disease is yet mainly in the congestive state.

The following are some of the special applications of the remedy.

In *pseudomembranous inflammation of the mouth and fauces*, it is almost a specific, so far as the local disease is concerned. Even in *pseudomembranous croup*, it has been employed with success, by the introduction of a strong solution through the rima glottidis into the interior of the larynx; and would probably prove more frequently effectual, were it not for the depth into the bronchial tubes to which the disease too often penetrates. In the false membrane which characterizes the *anginose cases of scarlet fever*, it should always be employed, especially if any disposition is evinced in the disease to spread towards the larynx. But, I would repeat, whenever nitrate of silver can be brought effectively into operation in pseudomembranous inflammation, wherever it may exist, so far as this affection is concerned, it may be expected to exercise a favourable modifying influence.

In *chronic stomatitis*, *angina*, and *laryngitis*, particularly of the *follicular character*, nitrate of silver, in connexion with such constitutional measures as the case may require, is the most effective remedy. A strong solution should be applied every other day, every day, or even more frequently, when the urgency of the case calls for it, and the membrane is not too sensitive to bear it.

In the commencing stage of *acute angina*, or *tonsillitis*, it will sometimes arrest the inflammation, especially in conjunction with general antiphlogistic measures; and, in *chronic enlargement of the tonsils*, it is probably the most efficient measure next to excision.

Chronic inflammation of the nostrils and *external meatus of the ear* yield perhaps more readily, on the whole, to this than any other local remedy. It is to the suppurative states of these affections that it is best adapted. *Ozæna* will, I believe, often yield to it, if properly applied to the whole diseased tissue. But, in both these affections, one great objection is the discoloration of the skin produced by it, which almost necessitates confinement on the part of

the patient, unless the application is conducted with the greatest care to avoid contact of the solution with the cuticle. The proper plan, in these cases, is to begin with a weak solution of the nitrate, say one or two grains to the fluidounce, and gradually increase, as the surfaces respectively are found to bear it, to five or ten grains or more.

Certain cases of *ophthalmia* are often much benefited by nitrate of silver. I have already spoken of ulcers on the cornea and conjunctiva, in which it is an almost sovereign remedy. In the *purulent ophthalmia of children*, a strong solution has been employed successfully; and in the *thickening of the palpebral conjunctiva*, which sometimes maintains a chronic inflammation of the eye, it is perhaps the most efficient application. In *ordinary chronic conjunctivitis*, it may also be used, but milder remedies will generally be found sufficient.

Psorophthalmia, according to my experience, yields to it more readily than to any other application.

In *inflammation* of the *mucous membranes of the rectum*, *urethra*, and *vagina*, it is not less effective than in those already mentioned, and it has even been used in mucous inflammation of the *bladder*. To its use in *dysentery* I have already alluded. In *leucorrhœa*, it is often very effectively applied to the os uteri and vagina; and in recent *gonorrhœa*, both in the male and female it is asserted sometimes to prove effectual; but it has also sometimes greatly aggravated the affection, which should be treated by milder measures. In *chronic gonorrhœa* or *gleet*, it is clearly indicated.

Cutaneous inflammations are scarcely less benefited than those of the mucous membrane. Mr. Higginbottom strongly recommended it in *erysipelas*, and it will undoubtedly often remove the disease; but it sometimes also fails, is disagreeable from the discoloration it produces, and, on the whole, is perhaps less effective than some other measures of suppression. In relation, however, to erysipelas, my own impression is that, as it is the result frequently of a constitutional disorder, it is better, as a general rule, that it be allowed to run its course, under gentle demulcent applications, with the use of suitable constitutional measures; care being taken to prevent its progress, when disposed to extend far, and into dangerous positions. For the latter purpose, a solution of the nitrate has been recommended; a broad band being drawn with it around the erysipelatous surface, embracing the outer border of the inflamed and an equal portion of the sound skin, to the breadth of about two inches.

But here also the remedy occasionally fails, and iodine, or perhaps even an ordinary blister, is preferable.

In *various cutaneous eruptions*, especially of a limited character, the nitrate of silver is often very useful. If applied to each one of the *variolous pocks*, on the first or second day, it will generally render them abortive, and thus prevent unseemly scars and pitting of the face. In *porrigo* or *favus*, similarly applied to each of the eruptions, it will generally completely arrest that obstinate disease, probably by destroying the cryptogamic growths on which it depends. In the clusters of *eczema* and *herpes*, and the pustules of *ecthyma*, it will often also prove effectual. But the discoloration of the cuticle produced by it is a strong objection, in all the eruptive affections covering extensive portions of the surface, in which, therefore, other remedies are usually preferred. In *excoriations*, as of the nipples, and cases of *intertrigo*, the solid nitrate is sometimes usefully employed.

Subcutaneous inflammations are sometimes benefited by the remedy; as *paronychia*, *furuncles*, *phlegmons*, *inflamed absorbent glands*, &c.

Application. For its caustic effect, the salt may be applied in substance, or strong solution. In the first method, it will be found most convenient to use the pointed stick. The *caustic solution* may be made of the strength of from one to three drachms to the fluidounce of water; or even a saturated solution may be used, if deemed advisable. It is usually best applied by means of a camel's-hair pencil; and care should generally be taken not to extend its application beyond the diseased surface. For *stimulant* and *alterative purposes*, the solution employed may vary in strength, from one to forty grains to the fluidounce. When applied to sensitive membranes, as those of the eye, ear, nostrils, urethra, and bladder, a weak solution should be used at first, say from half a grain to three grains to the fluidounce, and increased in strength as the parts may be found to bear it. For injection into fistulous sores, or simply as a stimulant to indolent ulcers, the proportion may be from three to ten grains to the fluidounce. When applied to acute inflammations, its strength should be considerable, say from ten to twenty, forty, or even sixty grains to the fluidounce, as the weak solutions only irritate, and do not subvert the disease. In erysipelas, Mr. Higginbottom used the pointed stick, or a solution nearly saturated. In affections of the mouth, fauces, and laryngeal mucous membrane, the solution should generally be strong. The menstruum should be pure dis-

tilled water, or rose-water, which is also distilled. Any saline matter present would probably decompose the nitrate.

When *injected into one of the cavities*, a silver or glass syringe should be preferred. For application to *an ulcer on the cornea*, I usually employ a fine-pointed camel's-hair pencil, which is first moistened, and then rubbed upon a piece of the nitrate, so as to make a saturated solution at the point, which is gently applied to the little ulcer. Any mechanical injury from the hard-pointed stick is thus avoided. In the treatment of *psoropthalmia*, the same measure may be employed. Remove mechanically the crusts formed at the root of the eyelashes, and then touch the diseased points with the extremity of the hair-pencil. To the thickened *palpebral conjunctiva*, as also to the *os uteri and vagina*, the stick may be applied with safety when required; but, in the former case, care should be taken to remove any superfluous nitrate. To narrow *fistulous* sores, of a callous character, it may sometimes be advantageously applied by first dipping a silver probe into nitric acid, which forms a nitrate on the surface, and then introducing it into the ulcer. In all cases, after the application of the caustic, should it be desired to remove the superfluous nitrate, this may be done by washing the surface with a solution of common salt.

An *ointment* has been used in *erysipelatous inflammation*, and some other external affections, made with one or two parts of the finely powdered nitrate to four parts of lard, which, applied twice a day to the inflamed surface, produces severe pain, with vesication, but is said to extinguish or arrest the erysipelas.

Finally, this salt, in a state of impalpable powder, mixed with an equal weight of lycopodium, has been used by way of inhalation, with supposed advantage, in laryngeal and bronchial inflammation. (Cornell, *Bost. Med. and Surg. Journ.*, Sept. 25, 1850.) Dr. Ebert, of Berlin, recommends the same remedy in all laryngeal mucous inflammations. He mixes three grains of the nitrate with a drachm of sugar, which he puts into a steel pen, firmly inserted in a quill open at both ends. One end of the instrument is introduced into the mouth so that the point of the steel pen lies over the root of the tongue. The patient then closes his mouth, and inspires strongly through the tube. The first trial generally fails, but the patient succeeds at last. A little cough and irritation follow, but without any considerable pain. (*Ed. Med. Journ.*, July, 1855, p. 54.)

III. SULPHATE OF COPPER.

CUPRI SULPHAS. *U.S., Lond., Ed., Dub.*

Syn. **Blue Vitriol.**

Sulphate of copper has been so fully treated of among the tonics (i. 407), and emetics (ii. 450), that we have here to consider it only as an external remedy. Locally applied, it is stimulant, astringent, and escharotic. It acts, however, mildly as a caustic; its influence, like that of nitrate of silver, being generally confined to the surface of the tissue. Like that medicine, moreover, it produces its escharotic effect by combining with the albumen or other organic constituent of the tissue, and thus causing decomposition. When applied to an ulcer, it forms a bluish-white compound upon the surface.

With reference to its escharotic property, it is used to destroy *warts*, *fungous granulations*, and the surface of *indolent*, or *callous ulcers*, the healing of which it thus greatly promotes. For these purposes, it may be used in the solid state, and may conveniently be shaped into the form of a small cylindrical stick, which may be attached to a convenient handle.

In solution it is used as a stimulant, alterative, and styptic. It is not unfrequently used as a wash for *chancres* and other *specific ulcers*, *indolent ulcers* of all kinds, and those ulcerous affections of the mouth and fauces denominated *cancrum* and *gangræna oris*, in which it is often extremely useful. For these purposes, a solution may be used containing from ten to twenty grains to one fluidounce; and, in applying it, care must be taken not to bring it unnecessarily into contact with the sound tissue.

Of a similar strength, it may be used as a *wash for bleeding surfaces;* and, when the source of the hemorrhage is not extensive, may even be used in the solid state, as in the cases referred to above.

It has also been used in weaker solution as a stimulant and astringent wash for chronically inflamed mucous membranes, as in *ophthalmia*, *gleets*, and *leucorrhœa*. In these cases, the strength of the solution should not at first exceed one or two grains to the fluidounce.

IV. ARSENIOUS ACID.

ACIDUM ARSENIOSUM. *U. S., Lond.*—ARSENICUM ALBUM. *Ed.*—ACIDUM ARSENIOSUM PURUM. *Dub.*

Syn. White Arsenic.—White Oxide of Arsenic.

Effects. For a general account of arsenic, including arsenious acid, see *pages* 306 and 322 of the present volume. As an escharotic, it is somewhat peculiar in its properties and applications. When applied to a living tissue, so far diluted as not to prove caustic, arsenious acid is powerfully irritant, exciting sometimes intense and diffusive inflammation. In a more concentrated state, it is an energetic escharotic, but usually causes intense pain before destroying the life of the part, and gives rise to much inflammation in the contiguous living tissue. When the cuticle remains, it exercises comparatively little caustic influence. Moreover, if applied at the same time to diseased and healthy structure, it is said to act preferably as an escharotic upon the former, which it is asserted sometimes to destroy, while it merely inflames the latter. Another interesting fact, in relation to its local effect, is that it is strongly antiseptic, preserving animal structure, immersed in its solution, unchanged in appearance for years.

From all these facts, it may be fairly inferred that arsenious acid acts dynamically as a caustic, and not by chemical combination with the tissues. Through its intense irritant action, it probably produces a degree of excitement in the part beyond its capacity to support. Upon this principle may be explained its preferable escharotic action upon the diseased tissue, which has less vital power of resistance than the healthy. Hence, too, the violent pain which precedes the death of the part. Were it through a chemical influence that it acted, the cuticle should not afford the impediment it seems to do; and normal structure should yield as readily as the morbid. It appears to me, also, that dead organic matter should exhibit stronger evidence than it does of a decomposing action on the part of the acid.

Another consideration of great importance, in regard to the use of arsenious acid externally, is that it is capable of exercising its constitutional influence by absorption from without. Numerous cases of fatal poisoning by this substance, externally applied, have been placed on record. This fact renders extreme caution necessary in its use. At one time, it was supposed that the danger was in pro-

portion to the quantity applied, and that the main caution demanded was not to employ it too largely. But a certain amount is necessary for any extensive caustic effect, and that quantity, if absorbed, would be sufficient to prove fatal. Danger is, therefore, necessarily incurred by its external use as an escharotic. It is true that it has been employed, with perfect impunity, in a vast number of cases; and, with those who believe that it is capable of doing much good, the circumstance of these comparatively rare cases of death, would not operate to its exclusion, were there no other remedy capable of the same therapeutic effect. It becomes, therefore, important to decide which is the mode of application least liable to the poisonous result. At present, the weight of testimony, as well, I think, as of reason, is in favour of the opinion, that it is least dangerous when freely used, so as to produce the death of the part quickly and effectually. Dead structure does not absorb. If a part, therefore, is destroyed by the arsenic, it not only takes up none of the poison itself, but serves, in some degree, as a barrier between it and the living and absorbing tissue. The practical conclusion is, that, when arsenious acid is employed as an escharotic, it should be applied freely; and, when as a mere stimulant or alterative to the part, that the quantity used within a given time should not be sufficient, if the whole of it were taken into the system, to produce fatal effects.

Another important point, ascertained by observation, is that a freshly cut and bleeding part absorbs the arsenical preparation much more rapidly than the surface of an ulcer; and, consequently, it should never be applied to such a surface.

Medical Uses. The ancients were acquainted with the escharotic property of the arsenical preparations, and used the sulphuret for a depilatory. It was formerly also employed considerably, as an external remedy, in various cutaneous diseases, and not without beneficial effect. But the dangers of its use have tended to limit its application, in recent times, to more serious affections.

Cancerous, and other *malignant ulcerous* affections, are those in which arsenic has been most used, and has the highest claims to consideration. Most of the nostrums which have, at different times, obtained greater or less repute in the treatment of these complaints, have been found to contain arsenic as their chief ingredient; the others serving for the most part merely to dilute or conceal it. It is impossible entirely to refuse credence to the many statements of regular, as well as irregular practitioners, to the effect, that arse-

nious acid often greatly ameliorates these ulcers and tumours, and sometimes completely eradicates them. It is said, as before stated, to destroy preferably the substance of the tumour. An eschar forms, which, after two, three, or four weeks, separates, leaving a surface sometimes healed, or in a fair way to heal, and frequently very much improved. It is very certain that many of the tumours thus permanently removed, and ulcers healed, were not really carcinomatous; but some possibly were, and there is no doubt that many real cancerous affections have been ameliorated. Admitting all this, however, it is a serious question, whether all the good that has been achieved, in relation to cancer, might not be better obtained by the knife, and with greater safety. Surgeons had generally come to this conclusion, before the use of anæsthetic inhalations in surgical operations; and, since that time, the conclusion has been strengthened; as the knife has been deprived, in great measure, of those terrors which weighed so greatly in the decision between it and the use of caustic. Whenever it is proper that a tumour should be removed, the knife is not only a more certain, but a less painful, and in all respects less disagreeable means of extirpation than escharotics.

But there are destructive ulcerous affections, which the surgeon would not venture to attack with the knife; and there are stages of cancer, in which few would think of employing it. Here there is ground, at least debatable, for the use of arsenious acid; and, whether that agent be employed or not, must be determined by the individual judgment of the practitioner, after examining the different sides of the question. I am inclined to think that we should do wrong, to throw away entirely a remedy which is capable, if not of saving life, certainly of protracting and rendering it more comfortable. The practitioner should bear in mind the practical rule above given, as deduced from general observation, that the acid should either be used freely, so as quickly to cauterize, or in very small quantities, as a stimulant, insufficient if absorbed to destroy life. In the latter method, it may be applied without hesitation to obstinate, destructive, and malignant ulcers, whenever it is found capable of alleviating them; in the former, it should be restricted to cases, which would in all probability prove fatal without it.

In *ulcerous lupus*, arsenious acid was used advantageously by Dupuytren, diluted with twenty times its weight of calomel, and either dusted on the ulcerated surface, or applied in the form of paste

made with mucilage. He removed the application at the end of two or three days, and renewed it five or six times when necessary.

According to Dr. Pereira, Mr. Luke, Surgeon of the London Hospital, considers a mixture of two grains of arsenious acid and an ounce of spermaceti ointment, as almost a specific in *onychia maligna*. (*Mat. Med.*, 3d ed. p. 666.) Under corrosive sublimate, I shall have to speak of another remedy equally certain. But diluted to this extent, I should conceive the acid perfectly safe, when applied to small ulcers.

It is customary to dilute arsenious acid with sulphur. For use as a stimulant or alterative, one grain of the acid may be mixed with a drachm of sulphur, and then incorporated with seven drachms of simple ointment; and the strength might well be doubled, or even quadrupled, when the extent of surface to be covered is small. Sir Astley Cooper employed, with a view to the caustic effect, an ointment consisting of a drachm of arsenious acid, a drachm of sulphur and an ounce of spermaceti cerate, to be removed at the end of twenty-four hours. The arsenical powder of Frère Cosme and Rousselot, which is recognized by the French Codex, consists of one part of arsenious acid, two of dragon's blood, and two of porphyrized cinnabar, and is to be applied in the form of a paste made with the saliva, or with mucilage. Particular formulæ, however, are of little importance. One part of the acid may be incorporated with from four to eight or nine parts of inert material, either in the form of an ointment, or of a paste made with mucilage. It might be well to add a little of one of the salts of morphia to allay pain.

V. CHLORIDE OF ZINC.

ZINCI CHLORIDUM. *U. S., Lond., Dub.*

Preparation. Chloride of zinc is best prepared by dissolving zinc in muriatic acid, filtering the solution, evaporating it to dryness, melting the residue in a crucible, and pouring the liquid upon a clean surface of stone to harden. The metal combines with the chlorine of the muriatic acid to form the chloride of zinc, and the hydrogen escapes with effervescence. The remaining steps are merely to obtain the preparation in a convenient form. After solidification, it is broken into pieces, and kept in a well-stopped bottle.

Properties. This salt is translucent, of a waxy softness, a grayish-white colour, inodorous, and of an acrid, astringent, metallic taste. It is soluble in water, alcohol, and ether, extremely deliquescent, fusible, and at a high temperature volatilizable unchanged. It is apt to be impure, in consequence of impurities contained in the zinc out of which it is made. For an account of these, and the methods of detecting them, see the U. S. Dispensatory.

Effects. Chloride of zinc is locally irritant and escharotic. When applied in a state of concentration necessary for the caustic effect, it produces a sensation of warmth, quickly followed by a severe burning pain, which continues for several hours. After the cessation of the pain, if the part be examined, it will be found covered with a white eschar, which soon begins to separate, and usually falls off in about ten days. The action is less rapid and extensive than that of potassa, and the pain is more severe and lasting than that occasioned by nitrate of silver; but it produces a much deeper slough than the latter caustic. It appears to exert a tonic influence on the surrounding tissues, with less inflammation than proceeds from arsenious acid. It is believed to owe its escharotic operation to a chemical union which it forms with the albumen and gelatin of the tissues. It has the advantage over arsenious acid as an escharotic, that it never injuriously affects the system through absorption. At the same time that it possesses these caustic properties, it acts as a preservative to dead animal tissues, and corrects foul odours by decomposing the emanations on which they depend, especially hydrosulphate of ammonia.

Uses. For the internal uses of chloride of zinc, see *page* 423 of the *first volume*. It is chiefly employed with a view to its escharotic effects, and was introduced into use as a substitute for arsenious acid, which it was thought to resemble in escharotic properties, without its dangers. It is especially useful in cases of *lupus*, but is also employed for destroying *cancerous tumours* and other *heterologous growths*, *aneurisms from anastomosis*, and *nævi materni*, and has been used successfully, by M. Bonnet, in a case of *aneurism of the subclavian* from a penetrating wound. Other uses of it have been in the cure of *fistula in ano*, for the perforation of the case of new bone in necrosis, and as an application in chancre.

Application. In consequence of its extreme deliquescence, it cannot in general be applied alone, as it would be impossible to limit its operation duly. Dr. Canquoin, of Paris, who was mainly instrumental in introducing it into use as a caustic, mixes it into a

paste with wheat flour and water. The paste is of different strengths, according to the effect desired, containing one part of the chloride with from two to five parts of flour, every ounce of which requires about fifteen drops of water. It is applied in layers of from one to four lines in thickness; and, in tumours, successive applications are made, as the eschars separate, until the whole diseased structure is removed.

Dr. Alexander Ure, of Glasgow, obviates the disposition of the caustic to run, by mixing it with finely powdered anhydrous sulphate of lime, which has the property of absorbing the moisture. It is thus more accurately limited than in any other mode; for the paste, made of a suitable consistence, retains its form for a long time. The duration of the pain is thus lessened, as the liquid chloride is prevented from running into the sound parts. When the cuticle is sound over a tumour to be destroyed, it should be removed by a blister, previously to the application of the caustic. Dr. Conway, of Richmond, Va., who recommends the chloride of zinc in chancre, applies the saturated solution formed by its deliquescence directly to the sore, and, if it has been too freely applied, washes it off with water, which may be most readily done by a moist sponge. (*Va. Med. and Surg. Journ.*, iv. 473.)

Professor Landolfi, of Naples, recommends strongly, in the treatment of malignant tumours, a combination of the chlorides, of which the *chloride of bromine* is the chief, and that on which he appears mainly to rely. He supposes that a specific power is exercised by this compound, which changes the nature of the disease, and thus renders it curable. His latest formula consists of 3 parts of chloride of bromine, 2 of chloride of zinc, 1 of chloride of antimony, and 1 of chloride of gold, which are to be mixed, and made into a paste with powdered liquorice root. Considerable success is claimed for this compound. (See *Arch. Gén.*, May, 1855, p. 610.)

VI. CORROSIVE CHLORIDE OF MERCURY.

HYDRARGYRI CHLORIDUM CORROSIVUM. *U. S.*

Syn. Corrosive Sublimate.

This has been described among the preparations of mercury (ii. 294). Locally, it is irritant, and, in a concentrated state, moderately caustic. As corrosive sublimate has a strong affinity for albumen, it is not impossible that it may operate chemically as an escharotic; but

I am disposed to think that its action is in part at least dynamic; as it is a powerful local irritant, and its corrosive effect is greater upon diseased than sound tissue. It is seldom used as an escharotic; but chiefly as a stimulant and alterative application in cutaneous eruptions, chronic mucous inflammation, and indolent or specific ulcers.

There is, however, one affection, in which, from considerable experience of its good effects, I would strongly recommend it, with a view to a caustic effect. Under the name of *onychia maligna*, we occasionally meet with an extremely obstinate ulcer, situated around the nail of a finger or toe, attended with considerable swelling, of a fetid odour, and very ill-conditioned appearance, which frequently separates the nail, and seems to show no tendency to heal. Formerly it was deemed necessary sometimes to amputate the finger or toe. I have never met with a case which refused to yield to the following treatment, which originated with the late Dr. Perkins of Philadelphia, and was strongly recommended by Dr. Physick in his lectures. Equal parts of corrosive sublimate and sulphate of zinc, well powdered, are thoroughly mixed; the mixture is sprinkled thickly on the ulcerated surface, so as to cover the whole of it deeply; a pledget of lint thoroughly wet with tincture of myrrh is placed over the powder; and the whole dressed with a compress and bandage. It is of little consequence what alcoholic liquid is used; the object of it being that it should act as a solvent to the mercurial salt. I have generally substituted laudanum for the tincture of myrrh. Severe pain is experienced, which ceases in half an hour or less; and, upon the removal of the dressings, some hours afterwards, an eschar is seen to have formed, covering the whole surface of the ulcer. This is thrown off in the usual time, and a healthy surface left, which heals without difficulty. The peculiar merit of the preparation seems to be, that the escharotic, dissolved by the alcoholic liquid, penetrates to every part of the diseased structure about the root of the nail, and everywhere destroys it. Little effect is produced upon the sound flesh. Whether the chloride would answer the same purpose without the salt of zinc, I do not know; for I have never tried them separately.

As a local stimulant and alterative, corrosive sublimate is a good deal used. Dissolved in water, in the proportion of from five to ten grains to the fluidounce, it is an excellent application to syphilitic ulcers of the fauces, or secondary ulcers of the same character elsewhere, which seem indisposed to heal under constitutional treatment alone. It should be applied by means of a camel's-hair pencil, so as

not to touch the sound parts. Employed in the same way, it would probably prove useful in other indolent and ill-conditioned ulcers. A weaker solution, containing one or two grains to the fluidounce, may be used as a lotion for indolent cutaneous affections, requiring a gentle stimulation. It may be used in lepra and psoriasis, and in acne to hasten the suppuration. The same solution has been employed to destroy insects in the hair, in different parts of the body. A still weaker solution, containing from an eighth to half of a grain in the fluidounce, is used as a collyrium in chronic and syphilitic ophthalmia, as a gargle in venereal sore-throat, and as an injection in gleet and leucorrhœa. The addition of alcohol facilitates the solution of the salt in water, and, when it is used in large proportion, this addition may be usefully resorted to.

Trousseau and Pidoux insist strongly on the efficacy of a solution of this salt in *pruritus of the vulva*. They dissolve 1 part of corrosive sublimate in 100 parts of alcohol, and direct a fluidrachm of the solution to be added to a pint of hot water, which is to be employed as an injection or lotion, as hot as it can well be borne. (*Trait. de Thérap.*, 4e ed., i. 206.)

The use of this salt in baths has been already noticed (ii. 299).

VII. ACID NITRATE OF MERCURY.

HYDRARGYRI NITRAS ACIDUM.—HYDRARGYRI PERNITRATIS LIQUOR.—*Solution of Pernitrate of Mercury.*

This is prepared, according to the directions of the Dublin College, by dissolving two avoirdupois ounces of mercury in a fluidounce and a half of pure nitric acid, diluted with an equal measure of water, and evaporating to the bulk of two fluidounces and a half. The preparation consists of deutoxide of mercury neutralized by nitric acid, with a considerable portion of the acid in excess.

It is a powerfully irritant and caustic liquid, highly esteemed by some practitioners in Europe, where it has hitherto been much more used than in the United States. It is employed in *lupus*, in which it is considered as one of the best applications, in *ulceration of the neck of the uterus*, in *cancerous* and *sloughing ulcers*, *carbuncles*, *moles*, *nævi materni*, &c. To hasten or abort the indolent pustules of *acne*, and to produce a similar effect in large *furuncles*, it has also been recommended; a minute drop in the former, and a

full-sized drop in the latter, being applied, by means of a fine brush, to the apex of the little tumours. (*Med. Times and Gaz.*, Jan. 1855, p. 9.) In all these cases, the liquid caustic is best applied by means of a glass brush, which is unaffected by the acid. It has sometimes produced ptyalism, through absorption.

VIII. DRIED ALUM.

ALUMEN EXSICCATUM. *U. S., Lond., Ed.*—ALUMEN SICCATUM. *Dub.*

Syn. Burnt Alum.—Alumen Ustum.

This is prepared by exposing crystallized alum (i. 134) to a moderate heat, until the water of crystallization is driven off, and then rubbing it to powder. It is necessary not to urge the heat too far, as otherwise a part of the sulphuric acid may also be driven off.

Dried alum is a white powder, of a very strongly astringent taste, and slowly soluble in water. It differs from the crystallized salt simply by the want of water of crystallization, and some modification in its molecular condition.

It is a very mild escharotic, scarcely affecting parts covered with the cuticle, and only moderately the living healthy tissue; but acting with considerable energy on newly formed fungous growths. It is used chiefly to repress fungous granulations, or proud flesh in ulcers. In these cases, however, it does something more than destroy the exuberant granulations. By its astringency it counteracts the relaxation which occasions this sort of growth, and thus favours the healing of the ulcers. It is simply sprinkled on the diseased surface, so as to cover it with a thin layer of the powder. It is particularly useful in the fungous ulcers following burns.

IX. THE MINERAL ACIDS.

Though differing much in power, most of these acids act in a similar manner as escharotics. They rapidly destroy the cuticle, and then act with great energy on the parts beneath, decomposing them through chemical affinities for their constituents, and quickly producing extensive sloughs, if allowed to continue in contact with the parts. In consequence of their liquid form, their action cannot be so easily limited as that of the solid escharotics; and

the extent of their effects cannot be so well estimated. They are, therefore, comparatively little used; but, from the rapidity of their action, they are occasionally resorted to in urgent cases, especially when it is desirable to denude an extensive surface of the cuticle.

In violent stomachic affections, in which life is in imminent danger, one of these acids may be applied to the epigastrium, so as to separate the epidermis. Great caution is necessary not to allow their action to proceed too far, and, as soon as the desired effect is produced, to neutralize the remaining acid, by washing the surface over with a weak solution of one of the alkaline carbonates. The denuded surface may then be dressed with either simple cerate or resin cerate, according as it may be desirable to promote healing, or to sustain inflammation. In consequence of the powerful chemical action of the acids on organic, and on many mineral substances, it is somewhat difficult to apply them neatly. A sort of brush, however, for the purpose may be made by wrapping old linen around the end of a stick, securing it with a string, and ravelling the projecting border. Recently *glass brushes* have been introduced into use, and are admirably adapted to the purpose of applying liquid caustics. They may be made very small, so as to confine the application to a point, or in various degrees larger, so as to spread it more rapidly over broad surfaces.

1. SULPHURIC ACID.—ACIDUM SULPHURICUM.

The concentrated acid acts with vast energy as an escharotic. In its first operation, it whitens the parts by forming a compound with the albumen, but in the progress of its action blackens them, probably by a kind of charring process, which liberates the carbon. It is very rarely used in this state. For the denudation of the skin above referred to, nitric or muriatic acid is preferable in consequence of their less energetic action. In cases, however, of *entropium* and *ectropium*, or *inversion* and *eversion* of the eyelid, the acid has been employed by some eminent British surgeons; being applied, in the former case, upon the skin on the outside of the lid, and in the latter, to the exposed mucous surface. Of course, in each case, great care is taken not to allow its action to extend too far. It operates advantageously in the affection, through the contraction which attends the healing of the ulcer, left after the separation of the eschar.

Much diluted, the acid has been used as a *gargle* in sore-throat, as a mouth-wash in ptyalism, and as a tonic and astringent application to indolent ulcers and cutaneous eruptions. From half a fluidrachm to two fluidrachms may be added to a pint of water. An *ointment* prepared by mixing a drachm of it with an ounce of lard has been

used in cutaneous eruptions. It occasions inflammation and sometimes ulceration, and should be weakened when used for eruptions by an equal weight of lard. In this feebler form, it has been employed as a rubefacient liniment in rheumatism of the joints, &c. *Mixed with saffron* to the consistence of a paste, it has been employed by Velpeau as an escharotic, and found to answer well.

2. NITRIC ACID.—ACIDUM NITRICUM.

This is also powerfully escharotic, though less so than the sulphuric acid. It stains the cuticle yellow before destroying it, and imparts the same hue to other tissues. It operates no doubt in some measure by oxidizing the constituents of the part destroyed. In its concentrated state, it has been used for *denuding the cuticle*, to destroy *warts* and the *crusts of favus or porrigo*, as an application to *phagedenic ulcers*, and to decompose the poison in the *bites of rabid animals*. It is said to be peculiarly useful in phagedenic ulcers, to the whole surface of which it is applied, so as to form a firm dry crust. To restrict its action, the parts around should be protected by resin cerate or plaster. Dr. Henry Smith, of London, strongly recommends it in certain cases of *piles*, with a prolapsed condition of the rectum, and an unhealthy and vascular state of the mucous membrane. The strong acid is applied freely to the diseased membrane, and occasions a good deal of pain at first; but, after the subsidence of this, there is little further suffering. (See *Lond. Med. Times and Gaz.*, Aug. 1854, p. 185.)

Largely diluted, it has been used as a wash for *indolent*, *carious*, *sloughing*, and otherwise *ill-conditioned* ulcers; and, in the form of an ointment, in chronic skin diseases, especially impetigo in its advanced stages. (See *vol.* i., *p.* 373.)

3. MURIATIC ACID.—ACIDUM MURIATICUM.

Muriatic acid is an energetic caustic, but less so than either of the preceding, as its chemical reactions with the tissues are not so powerful. It has been used to denude the cuticle, and as an application to pseudomembranous exudations in the mouth and fauces, in which it was highly esteemed by Bretonneau, though now superseded by nitrate of silver. It has also been used in ulcers of the mouth, especially those denominated *cancrum oris*. Diluted, it is used as a gargle in the sore-throat of malignant scarlet fever. For this purpose, one or two fluidrachms may be added to half a pint of water. An objection to this and other acid gargles is, that they are liable to injure the teeth.

Probably all that can be effected by this class of medicines can be gained from the escharotics above described. But numerous other substances, besides those mentioned, have similar properties, and have been more or less used. The following is a list of a few of the least valueless among them.

The *stronger solution of ammonia*, if allowed to remain in contact with the skin a few minutes longer than is necessary to vesicate, say from ten to fifteen minutes, will produce a slough, and may be used for this purpose in cases of great urgency. (See ii. 734.) *Hydrate of soda* is little less efficient than caustic potassa. *Lime* also has escharotic properties, and has occasionally been used in fungous ulcers. The *chlorides of soda* and *lime* have slight escharotic powers, as also have the *carbonates of the alkalies*. Of the metallic preparations, *chloride of antimony* or *butter of antimony*, *subacetate of copper* and *red oxide of mercury* may be added to the list.

CHAPTER III.

Local Remedies acting Mechanically.

THESE may be distributed into the four classes of *diluents*, *demulcents*, *emollients*, and *protectives*. Compressing agents might be added; as also the measures employed to regulate position; but it is the result in these cases, and not the means used to produce it that is remedial: and the latter are so closely dependent on manipulation for their efficiency, that they belong rather to the category of surgical instruments than of remedies.

CLASS I.

DILUENTS.

THESE are drinks which simply dilute the various liquids of the body, without dynamically modifying its condition or functions. Water is really the only diluent; for, however it may be qualified, in relation to sensible or nutritive properties by the substances added, though it may be made more grateful to the palate, and may accomplish other purposes incidentally, it is obvious that these additions do not affect the characteristic result. Nor is there any other liquid, so indifferent in its effects, as to be a fit substitute for water for this special purpose. Even water itself is not without positive dynamic effects on the system. I have already shown that, in excess, it is directly and universally sedative, and may even be made to reduce the vital actions to a point incompatible with life. It is only when in exact correspondence with the wants of the system that it is indifferent in its operation, neither elevating, depressing, nor perverting the normal actions. As a pure and exclusive diluent, therefore, it must be given only in correspondence with these wants; but it almost always happens that, when there is an indication for dilution, there is no contraindication

for a moderate sedative influence from water, locally or generally; and if it happens to be given in quantities beyond the necessities of the system, no injury results.

Aqueous drinks operate as diluents in every stage of their progress through the system. In the first place, they dilute the liquid contents of the stomach and bowels; secondly, they are absorbed and dilute the blood; and lastly, they are thrown off by different emunctories, and serve to dilute the secreted liquids, as the perspiration, bile, saliva, and urine, particularly the last.

They act beneficially by rendering the different liquids less irritating, and sometimes by facilitating, in consequence of an increased tenuity imparted to these liquids, their course through their various passages. In relation to the former effect, they are useful, as a general rule, in all irritative or inflammatory affections of the surfaces over which they pass, and in cases in which the liquids themselves are morbidly irritating. Let us trace the diluent liquid through its route, and note its therapeutic effects.

The stomach may contain acrid matters, which not only irritate the gastric mucous membrane, but give rise to various morbid sympathetic phenomena; especially headache. A drink of water often affords relief by diminishing the acrimony of the offending cause, until nature shall remove it in the ordinary operations of the alimentary canal. I have repeatedly known sick-headache, dependent on gastric irritation, to be completely relieved by a tumblerful of water, without any other observable effect. Hence, too, one of the advantages of free dilution in cases of acrid poisoning. But the gastric mucous membrane may be irritated or inflamed, independently of its contents, which nevertheless, though normal in their character, operate as an irritant to it in its more sensitive condition. Here, too, diluent drinks are often also of advantage, and, if taken in small quantities, and at a temperature in accordance with the indications, may afford relief simply by diminishing the irritant action of the gastric liquids. Cold water, in small quantities, frequently administered, is not only very grateful, but may be positively useful also in gastritis. These remarks are equally applicable to irritating contents of the bowels, or an inflamed state of the intestinal mucous membrane. Diluent drinks are, therefore, serviceable in diarrhœa of irritation, enteritis, and dysentery.

Following the drinks into the blood-vessels, we find them often of great service by rendering the blood less irritating, in all fevers with thirst and a hot skin, and in all acute inflammations. In some

instances too, when the blood is thickened by loss of its serosity, the water answers a good purpose by restoring the normal fluidity. On this principle, it probably does good in cholera.

When thrown out with the secretions, we find the diluents peculiarly useful in irritative diseases of the urinary organs, and in acrid states of the urine. Hence their beneficial effects in nephritis, pyelitis, cystitis, urethritis, various forms of gravel, and strangury from acrid impregnation of the urine, as under the use of cantharides or the oil of turpentine.

As regards their effects in thinning inspissated liquids, there is reason to think they are occasionally more or less beneficial in facilitating the discharge of most of the secretions; as of the tenacious mucus from the bronchial tubes, the inspissated bile from the biliary ducts, and the thickened urine from the uriniferous tubules of the kidneys.

In the administration of these liquids regard should be had to the choice of the patient, the demands of the stomach, and various coincident indications. Sometimes pure water is preferable to any form of admixture. Generally it may be rendered more agreeable to the palate by saccharine and acidulous additions, and various flavouring substances, and may be made the vehicle of sufficient nutrition to the system, by dissolving in it some gummy or amylaceous substance. In febrile diseases, acids are not only grateful, but useful as refrigerants. In irritable states of the stomach, carbonic acid water is often a very appropriate and useful adjuvant. In debility, the diluent may be renderent somewhat stimulant by wine or spirit.

As examples of drinks of this kind, of which the practitioner cannot have too many at his command, to meet the wants and caprices of the patients, or the various calls of disease, may be mentioned, molasses and water, sugared water, toast-water, barley-water, solutions of gum arabic, arrowroot, tapioca, or sago, infusions of flaxseed, slippery-elm, benne leaves, and sassafras pith, lemonade, orangeade, apple-water, tamarinds and water, currant or blackberry jelly diffused in water, and carbonic acid water; and not a few others might be mentioned. As a general rule, they should be administered cool or cold, and in small quantities at a time; though conditions sometimes exist, in which both these directions may be contravened with propriety; as for example in sick-headache, in which a tumblerful of warm water is more useful than an equal quantity taken cold, and in repeated draughts.

CLASS II.

DEMULCENTS.

THESE are substances of a bland unirritating character, soluble in water, and capable of imparting to that fluid more or less viscidity or adhesiveness. They generally consist of gummy, saccharine, or farinaceous substances, or of two or more of these combined.

Therapeutically they operate in three ways; 1. by covering over and sheathing irritated surfaces, and thus protecting them, in some degree, from the contact of acrid or irritating materials; 2. by retaining the surfaces in a moist state essential to a proper performance of their functions; and 3. by mingling with acrid substances, and obtunding their acrimony.

1. So far as concerns their first method of action, they correspond with the class which I propose to call protectives; and I shall postpone a full consideration of the principles by which their therapeutic results are produced, till we come to the consideration of that class. Examples of their effects in this way are afforded in the relief of cough, obtained by holding gum arabic in the mouth, and swallowing it as it slowly dissolves in the saliva; and in the alleviation of inflammation of the conjunctiva, by mucilage of sassafras pith introduced into the eye. In the former case the mucous membrane of the fauces, and in the latter the conjunctiva, are protected against the influence of the air, which tends to sustain the inflammatory condition.

2. The second principle of action, so far as the demulcents are concerned, is more efficient. Inflammation of the exposed surface is generally attended with more or less diminution of secretion, and with a corresponding degree of dryness. The pliability and softness of the tissues, produced by a due degree of moisture, is essential to the performance of their functions. The movements necessary everywhere for the performance of function, cannot be duly effected in a rigid and hardened condition of the parts. But attempts at these movements are always made, and, without accomplishing their intended object, they excite irritation and sustain

inflammation, possibly by friction, possibly by rupture of the minute and rigid fibrils of the tissue. Suppose, with a diseased and stiffened condition of the skin in the ham, or the flexure of the elbow, we should nevertheless move these joints in the performance of their respective offices; we should have, in the cracks, the hemorrhage, the inflammation, which would certainly follow, an illustration, upon a large scale, of what may be supposed to take place in the invisible molecular movements of a tissue, deprived of its due amount of moisture, and consequent mobility. Hence, an inflammation in the exposed mucous membranes and skin has a tendency to sustain itself by the condition of the tissue it produces; and, if we can artificially correct that condition, we remove one great source of irritation, and favour the influences which tend towards health. Every one knows how much relief is obtained in the dry skin of erysipelas, and the dry mouth and throat of angina, by keeping the parts constantly moistened. Demulcents enable us, in a good measure, to accomplish this object, either through their own essentially moist nature, as in the instance of glycerin, or by the tenacity with which they hold on to the water in which they are dissolved, or which is incorporated with them, as in the mucilage of flaxseed or slippery elm. It is not by any immediate influence of its own, that the gummy substance gives relief. It merely acts the mechanical part of retaining the requisite moisture.

There is another method in which water acts in the relief of inflammation, besides that of maintaining the necessary physical condition of the tissue; it is by the direct sedative influence which it exerts when in excess, and which has been already fully discussed under the general head of sedatives.

3. The third principle of action, with the demulcents, is the influence they have upon the irritating cause. We all know that by mixing an acrid substance with gum or sugar, it loses its sharpness of impression on the palate in much larger degree than could be explained from the mere dilution. Its particles, becoming mingled with those of the viscid matter, have less facility of movement than before, and come into contact by fewer points with the impressible membrane. So it is also with other tissues beside that of the organ of taste. The influence of an irritant is almost universally diminished and obtunded by demulcent admixture. Acrid medicines, when swallowed, not only affect the taste less when mixed with demulcent matter, but the stomach also. Besides, when demulcents are swallowed, they mingle with the acrid contents of the stomach,

and possibly of the bowels, and moderate the irritant influence these contents exercise on the mucous membrane. Injected into the bladder, the vagina, the rectum, the ear, the nostrils, they produce the same effect in obtunding the acrimony of the morbid secretions in these parts, and diminish their injurious reaction on the tissues that produced them, or over which they pass.

The therapeutic deduction from the above considerations is obvious. Demulcents are extremely useful as remedies in inflammation and vascular irritation; and it is for their beneficial effects in these conditions that they are used as medicines. They relieve inflammation or irritation, by protecting the diseased part, in some degree, against the irritant action of the air and other external agents; they enable us to keep the parts moist, and obviate the mischievous effects which result from the opposite condition; and they diminish the irritant action upon an inflamed part of substances, the contact of which they cannot wholly prevent.

Incidentally, they have another advantage in the treatment of inflammatory diseases; that they afford, namely, precisely the kind of food which the circumstances of the case require, in the highest state of excitement. Gum, sugar, and starch are exactly the articles of diet suitable in the early stages of inflammations, and inflammatory fevers.

We may conveniently recognize three types of demulcent matter, and treat of the varieties under these respectively. They may be often mixed in nature; but we shall find that they are sufficiently distinct to enable us conveniently to make this arrangement. The demulcents, then, will be treated of, under the heads of mucilaginous, saccharine, and amylaceous substances.

1. *Mucilaginous Substances.*

By the term mucilage is here meant a solution, or an apparently liquid state of gummy matter. There are two sets of substances belonging to this category, one, those in which the gummy matter has been isolated, and is kept in that state, as gum arabic and tragacanth; the other in which it is still contained in the plants or parts of the plants affording it, and from which it must be extracted

for use by water, as flaxseed and slippery elm. It must be understood, too, that the gummy matter is not identical in the different medicinal substances consisting of or containing it, but that it is chemically more or less distinct in all. I shall treat first of the isolated gums, and afterwards of the others, but without further distinction.

I. GUM ARABIC.—ACACIA. *U. S., Lond., Dub.*—GUMMI ACACIÆ. *Ed.*

Origin. This is the concrete exuded juice of different species of *Acacia*, thorny shrubs or trees, growing in various parts of Africa and Arabia. The *Acacia vera* and *A. Arabica* have been usually considered as the most abundant sources of it. The gum-producing species generally grow in the deserts, and yield their product during the dry season, when the juice exudes through fissures in the bark, and hardens on the surface. The finest is brought from Upper Egypt and Nubia, and being exported from Alexandria, is usually called Turkey gum. Other varieties are brought into the market, under the designations of *Senegal*, *India*, and *Barbary* gums, &c. Though portions of these are of excellent quality; yet, on the whole, the Turkey gum is the purest and best for medical use, and should, I think, be exclusively kept for such purposes in the shops.

Properties. When unbroken, gum arabic is in pieces of irregular size and shape, usually roundish, and either translucent, or of a somewhat opaque appearance, in consequence of innumerable minute cracks or fissures with which they are pervaded. Each separate fragment, however, of such pieces is transparent. The best variety generally comes to us already broken into small angular fragments, which are beautifully shining, of a whitish colour, sometimes tinged with yellowish or reddish-brown, hard, brittle, and of a glossy fracture The powder is purely white. Gum arabic is inodorous, of a very feeble slightly sweetish taste, very soluble in water both hot and cold, and insoluble in alcohol, ether, or the oils. Alcohol precipitates it from a strong aqueous solution. Pieces of it held in the mouth slowly dissolve in the saliva. A solution of it precipitates a solution of subacetate, but not of acetate of lead, is gelatinized by sesquichloride of iron, and precipitated by nitrate of mercury.

Composition, &c. Gum arabic consists of *arabin* or *pure gum*, with some uncombined water, and a little saline matter, yielding, when the gum is burned, about three per cent. of ashes. Arabin or pure gum is composed of carbon, hydrogen, and oxygen, the last two

ingredients being in mutually saturating proportions, so that the gum may be said to be a compound of carbon and water.

If perfectly dry, gum arabic may be kept any length of time unchanged. Its solution, which is usually called mucilage, speedily becomes sour on exposure, especially in warm weather, in consequence of the production of acetic acid.

Effects and Uses. As regards any dynamic operation on the system, gum arabic is probably quite inert. It is simply a very bland article of food, of comparatively slight nutritious power. As a demulcent, it has the properties belonging to the class; but, retaining water with less tenacity than some other gummy substances, and becoming hard and stiff upon the drying of its solution, it is not well adapted for application to the exterior surface of the body. But for internal use it is one of the best, perhaps, upon the whole, the best of the demulcents, and is among those which are most used. A lump of it held in the mouth, and allowed slowly to dissolve, answers an excellent purpose in allaying coughs dependent on irritability of the fauces, and in soothing the inflamed membrane in anginose cases. The solution may be used in all acute febrile and inflammatory cases, and is particulary adapted to inflammation of the mucous membrane of the stomach and bowels. To cases in which acrid poisons have been swallowed, it is highly appropriate. It is also used freely in inflammatory conditions of the bronchial and urinary passages; but I am not confident that, in these affections, it operates in any other way than by pure dilution, in other words by the quantity of water taken with it. It not only acts as a demulcent, but affords also the kind of diet adapted to the highest stage of febrile and inflammatory excitement. To children it is peculiarly well suited, in both these capacities, in consequence of its want of taste.

For ordinary use, an ounce of the gum may be dissolved in a pint of water. If preferred, the solution may generally be flavoured with sugar and lemon-juice. In almost all cases, it should be taken cold.

Gum arabic is also much used for suspending insoluble substances, whether solid or liquid, in water, for the convenience of administration; and in the preparation of pills. Two drachms of it may be used in a mixture of six fluidounces.

The *Mucilage of Gum Arabic* (MUCILAGO ACACIÆ, *U. S.*, *Dub.*; MISTURA ACACIÆ, *Lond.*; MUCILAGO, *Ed.*) is an officinal preparation, made, according to the U. S. Pharmacopœia, by dissolving four ounces of the gum in half a pint of boiling water. Each

fluidounce contains half an ounce of the gum; and half a fluidounce may, therefore, be prescribed in preparing a mixture or emulsion of six fluidounces. When the powder to be suspended is heavy, a larger proportion may be used.

Under the name of *gum pectoral*, a demulcent compound is prepared by dissolving equal parts of gum and sugar, and evaporating the solution. It dissolves more slowly than gum, and on this account, as well as for its flavour, it is often used for the purposes of a demulcent lozenge in catarrhs and sore-throat.

II. GUM MESQUITE.

Under this name, a product has recently been introduced to the notice of the public, which promises, at some future time, to become an important article of commerce, and a useful medicine. It was brought from New Mexico by Dr. Geo. G. Shumard, of the U. S. Army, who accompanied an expedition sent by the government into the Indian country, under the command of Captain Marcy. It was obtained from a tree belonging to the same family as the Acacia, which extends through vast regions, and is capable of yielding an unlimited supply to commerce. The juice exudes spontaneously, and hardens on the bark.

As it has come under my notice, it is in irregular roundish pieces, of various size, and of different hues, from colourless transparency to a dark amber-brown. Some of the pieces have the fissured appearance of the Turkey gum. Examined by Professor Procter, it was found to resemble gum arabic in its solubilities, but to differ from that principle in some of its chemical reagencies. Thus, it does not, like that gum, precipitate a solution of subacetate of lead. (*Am. Journ. of Pharm.*, xxvii. 14 and 223.) Dr. Campbell Morfit, of Baltimore, found it to coincide closely with gum arabic in composition. (*Am. J. of Sci. and Arts*, 2d ser., xix. 263.)

On the whole, it is probable that this gum will be found to answer the same purposes as gum arabic in medicine and pharmacy; and it has this considerable advantage, that it may be mixed, without precipitation, with solution of subacetate of lead, to which it may thus impart demulcent properties. There is no other known gummy substance of which this can be said.

III. TRAGACANTH.—TRAGACANTHA. *U. S., Lond., Ed., Dub.*

This is a concrete exudation from *Astragalus verus*, and perhaps other species of Astragalus, small prickly shrubs, growing in Anatolia, in Asia Minor, where the drug is collected.

It is in pieces of various shape and size, usually contorted, flat or filamentous, oblong or roundish, extended or rolled up, of a whitish, yellowish, or brownish-white colour, slightly translucent, and of a somewhat horny consistence. It is inodorous, and nearly tasteless. Its powder is white. In contact with water, it absorbs that fluid, swells up very greatly, and assumes a soft pasty consistence, but does not wholly dissolve. It consists apparently of two ingredients, one soluble, and resembling if not identical with pure gum, the other softening and swelling up, but not dissolving in water. The latter has been called *tragacanthin*, but is probably identical with bassorin. Tragacanth is insoluble in alcohol.

In medicine, it is used almost exclusively as an ingredient in lozenges, in the preparation of which it is very useful, by its great tenacity and imperfect solubility, which causes them to dissolve slowly in the mouth. It is also used, in consequence of its viscidity, in the suspension of heavy powders.

IV. FLAXSEED.—LINUM. *U. S.*, *Dub.*—LINI SEMEN. *Lond.*—LINI SEMINA. *Ed.*

It is scarcely necessary to state that this is the product of the *common flax plant*, or *Linum usitatissimum*. The appearance of the seeds is too well known to require description. I shall content myself with calling attention to the properties, which render them valuable as a medicine.

The seeds of flax contain, in their investing coat, a large quantity of mucilaginous matter, which is imperfectly extracted by cold, but readily and abundantly by hot water, forming a thick mucilage. When this is evaporated to dryness, the residue is found to consist of a portion soluble in water, which is probably gum, and another insoluble, but swelling up and softening like the insoluble matter of tragacanth. The mucilage, therefore, is an imperfect solution, holding part of the gummy matter in suspension.

Besides this mucilaginous matter in the coating, there is in the interior of the seeds a large proportion of fixed oil, which may be obtained by expression, and which gives valuable emollient properties to the powder of the seeds. (See *Emollients*.)

It is the mucilage which imparts its demulcent virtues to flaxseed, and which, in preparing the medicine for use in this capacity, it is always desirable to obtain separate from the oleaginous ingredient.

Uses as a Demulcent. As a demulcent, flaxseed is used exclusively in the form of infusion. It has the general character of the

class in a high degree, and is very much employed. For external use, one of the medicines, hereafter to be considered, is generally preferred; but internally the infusion of flaxseed is largely prescribed. The complaints in which it is most frequently administered are *catarrhal affections*, *enteritis*, *dysentery*, and *inflammation or irritation of the kidneys and urinary passages*, including of course *strangury*. It is also frequently injected into the bowels, in irritated states of the rectal mucous membrane. In irritable conditions of the stomach, it is inferior to gum arabic, as less delicate, and usually less acceptable. It is often flavoured with sugar and lemon-juice, or with liquorice, and, when used in bronchial inflammation, as in ordinary colds of the chest, measles, &c., it is very advantageously associated with tartar emetic. In many cases of *catarrh*, nothing more is necessary than to give the patient daily, in small quantities at a time, frequently repeated, a pint or more of flaxseed tea, with one or two fluidrachms of antimonial wine in each pint.

The *infusion* may be made in the proportion of half an ounce of the seeds to a pint of boiling water. The seeds should not be bruised, and decoction should be avoided, as otherwise the oil might be extracted, and render the infusion less agreeable, and less acceptable to the stomach. The infusion, made with a smaller proportion of the seeds, may be used as a mucilaginous bath in cutaneous affections, extending largely over the body, and attended with much irritation, as urticaria, lichen, psoriasis, &c. Though probably not so much used externally as the infusion of slippery elm bark, it has the advantage over that demulcent, of not being precipitable by solution of acetate of lead, in such a degree as to be incompatible with their simultaneous use. When, therefore, it may be desired to combine the use of a demulcent and saturnine solution, flaxseed may be resorted to preferably to the bark just mentioned. It is incompatible with the subacetate of lead.

Compound Infusion of Flaxseed (INFUSUM LINI COMPOSITUM, *U.S.*, *Lond.*; INFUSUM LINI, *Ed.*) is prepared, according to the U. S. Pharmacopœia, by infusing half an ounce of the seeds, and two drachms of bruised liquorice root, in a pint of boiling water, and straining. A pint or more may be taken in twenty-four hours.

V. QUINCE SEED.—CYDONIUM. *U. S.*, *Lond.*

The fruit of *Cydonia vulgaris*, or the *common quince tree*, yields seeds, the coriaceous envelop of which abounds in mucilage, which they yield with great facility to boiling water. When the infusion is evaporated to dryness, the residue is found to be soluble in water,

and therefore to differ from the mucilage of flaxseed, and from tragacanth. From pure gum or arabin it differs in some of its relations. It is, therefore, considered peculiar, and by Dr. Pereira has been called *cydonin*. Two drachms of the seeds impart sufficient viscidity to a pint of water.

Mucilage of quince seeds is made use of exclusively as an external remedy, being applied in Great Britain to erysipelatous inflammation, inflamed hemorrhoids, cracked lips, sore nipples, and especially to the eyes in ophthalmia. In this country it is seldom used; its place being supplied by the demulcent to be next noticed, and the mucilage of sassafras pith. As it yields copious precipitates with the acetates of lead, it cannot be employed in connexion with them.

A *Decoction* (DECOCTUM CYDONII, *Lond.*) is directed by the London College to be made by boiling two drachms of the seeds for ten minutes in a pint of water. This is the preparation used as above mentioned. It does not keep well.

VI. SLIPPERY ELM BARK.—ULMUS. *U. S.*

Origin and Properties. This is the inner bark of *Ulmus fulva*, the *slippery elm* or *red elm*, of this country, a large and handsome tree, growing throughout the Middle and Northern States. The bark is usually in flattish pieces or strips of variable size, of a tawny colour, somewhat reddish on the inner surface, very fibrous, so that it may be bent double without breaking, of a sweetish and agreeable odour, and a feeble not unpleasant taste. When chewed, it fills the mouth with mucilage. Sometimes it comes into the market cut into small pieces, and sometimes in the form of a light, loose, tawny powder, produced by grinding.

Chief Constituent. The constituent upon which the bark depends for its medical virtues is a peculiar gummy matter, which it imparts readily to water, forming a very viscid solution. This is not, like gum, precipitated by alcohol, but affords copious precipitates with the solution both of the acetate and subacetate of lead.

Medical Uses. Slippery elm bark is one of the best and most agreeable of the demulcents, usually well received by the stomach. It is much used in this country both internally and externally. The infusion is a useful drink in catarrhal affections, diarrhœa, dysentery, and diseases of the urinary passages; and is an excellent application in cases of external inflammation. *Erysipelas*, the severe forms of *erythema*, especially *E. nodosum*, the inflammatory stages of *herpes*, *eczema*, and *impetigo*, all afford indications for its use; and, indeed,

it may be employed whenever, in consequence of local inflammation, there is a call for the application of cool water. As a demulcent, it is used in the form of infusion, which is most elegantly made out of the unpowdered bark.

Infusion of Slippery Elm Bark (INFUSUM ULMI, *U. S.*) is made by macerating an ounce of the bruised bark in a pint of boiling water. It may be taken without limitation as a drink. Externally, it is applied by means of linen cloths, several times folded, which should be thoroughly wet with the infusion, and never allowed to become dry, even at their edges. Unfortunately the strong incompatibility between it and both of the acetates of lead, forbids their simultaneous application, though it might be strongly called for by the symptoms; and this is the greatest objection to the bark.

VII. SASSAFRAS PITH. — SASSAFRAS MEDULLA. *U. S.*

Origin and Properties. This is the pith of the small terminal branches of our indigenous *Sassafras officinale*, or common *sassafras tree*. It is in very slender cylindrical pieces, of various lengths, extremely light and spongy, white with sometimes a yellowish tinge, inodorous, and of a mucilaginous and very slightly aromatic taste. It contains a large proportion of mucilaginous matter, which it readily imparts to water hot or cold, forming a ropy, but not very tenacious solution. The infusion is not precipitated by alcohol, very slightly by solution of acetate of lead, but copiously by the subacetate, with which, therefore, it is incompatible.

Medical Uses. The infusion of sassafras pith is a delicate demulcent preparation, which may be used externally and internally for the general purposes of the class. But it is most employed as an application to the conjunctiva in ophthalmia, in which it was strongly recommended by the late Dr. Physick, and is certainly sometimes very useful. In dry states of the inflamed or irritated conjunctiva, it supplies the place of the natural mucus in lubricating the membrane, at the same time that it in some measure protects it from direct contact with the air. The mucilage, too, is itself so bland as not to irritate even the delicate surface of the eye. It should be applied constantly over the closed lids, upon linen rags, and should also be allowed free access to the conjunctiva. It may be used externally with solution of the acetate of lead, but not with that of the subacetate.

Infusion of Sassafras Pith (INFUSUM SASSAFRAS MEDULLÆ, *U. S.*) is made in the proportion of a drachm of the pith to a pint of cold

water; and the proportion may be increased if desired. It may be drank *ad libitum.*

VIII. BENNE LEAVES. — SESAMI FOLIA. *U. S.*

Origin and Properties. These are the leaves of *Sesamum Indicum* and possibly of *Sesamum orientale*, annual plants, natives of the E. Indies and probably of Africa, and cultivated to a considerable extent in our Southern States. They will grow also in the latitude of Philadelphia with care, but do not ripen their seeds: so that, to maintain a supply of the fresh leaves, it would be necessary to obtain the seeds from the South. They are commonly known by the name of *benne plant.* The large leaves are three-lobed, and sometimes three are attached to the same footstalk. They abound in a gummy matter, which they yield with great facility to cold water, forming a transparent and very ropy mucilage.

Medical Uses. One or two of the large fresh leaves put into a tumbler of cold water, and occasionally stirred, will, in the course of a few minutes, render the liquid sufficiently viscid for use. The infusion thus prepared is a very bland mucilage, much used in the South as a demulcent drink in bowel affections, and those of the urinary organs. If dried, the leaves should be treated with hot water. They may be used also in the form of an emollient cataplasm.

IX. MARSHMALLOW. — ALTHÆA. *Lond.*

The marshallow, *Althæa officinalis*, is an herbaceous perennial plant, growing in low grounds, and on the borders of salt marshes, in Europe and the United States. The U. S. Pharmacopœia recognizes the *flowers* and *root* (ALTHÆÆ FLORES, and ALTHÆÆ RADIX, *U. S.*); the London the root only; the Edinburgh the root and the *leaves* (ALTHÆÆ FOLIA, *Ed.*). All parts of the plant abound in mucilage, and all may be employed; but it is chiefly the root which is used in the United States. It is imported.

Marshmallow root is in roundish or split pieces, several inches long, about as thick as the little finger, destitute of bark, of a downy appearance on the outside, white, of a slight peculiar odour, and of a sweetish taste. It imparts mucilage to the saliva when chewed. Besides the gummy matter, the root contains starch and sugar, which are extracted by decoction. When acted on by cold water, it yields the mucilage with little of the other ingredients.

Medical Uses. Marshmallow is used simply as a demulcent; and its applications are those of the class generally; so that they need not be repeated. The root is used in decoction, which may

be prepared by boiling an ounce in a pint down to twelve fluid-ounces.

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2. *Saccharine Demulcents.*

In employing the term saccharine here, I consider it simply as implying sweetness, in connexion with substances of vegetable origin, without reference to the property of undergoing the vinous fermentation, which has been considered as characteristic of the true sugars.

I. SUGAR. — SACCHARUM. *U. S., Lond.* — SACCHARUM PURUM. *Ed.* — SACCHARUM PURIFICATUM. *Dub.*

By the term sugar, is here meant the ordinary *refined sugar*, or *loaf sugar of the table*, which requires no description. It is dissolved in half its weight of cold, and in all proportions of hot water; and its solution, when of a certain strength, is called *syrup*. Though nearly insoluble in pure alcohol, it is dissolved to a considerable extent by officinal alcohol, and freely by ardent spirit or diluted alcohol. It melts with heat, and, at a somewhat higher temperature, is decomposed, giving out an agreeable odour, with a black residuary substance called *caramel*. When crystallized from its watery solution, it is called *sugar-candy*. Suddenly cooled from a state of fusion, it assumes the translucent but amorphous state, in which it is called *barley-sugar*. It has the important property of preserving organic matters from decomposition, and the singular effect of preventing the peroxidation of iron.

Medical Effects and Uses. Sugar has a low grade of nutrient power, which adapts it, as an article of food, to states of inflammatory and febrile excitement. But nature seems not to have intended that it should be a chief constituent of diet; for, taken largely, it cloys and oppresses the stomach, and, when digestion is feeble, is apt, even in moderate quantities, to undergo conversion abnormally into acid matter; which proves irritant both to the stomach, and sympathetically to the brain. Hence, it should be given to the sick only in small quantities, and, as a general rule, in connexion with other nutritive and demulcent substances, which it flavours agreeably.

Sugar is supposed to be laxative; and in its impure forms undoubtedly is so; but pure, as now considered, it has little if any effect of the kind. It is, however, decidedly demulcent, and is used in various modes in reference to this property. In the state of

barley sugar, *candy*, or some form of confectionery, or incorporated with gum in the form of *gum pectoral*, it is frequently used to quiet cough, and obviate dryness and irritation of throat in angina, by being held in the mouth, and allowed slowly to dissolve; and certainly often contributes to the comfort of patients in this way. Dissolved in water, so as to be agreeable to the taste, it is used as a demulcent drink in febrile and inflammatory diseases, especially among the French, with whom *eau sucrée* is held in no light estimation. More frequently, however, it is given with other demulcents, as gum, flaxseed mucilage, and the different amylaceous substances.

Sugar, though in general so bland, appears to have the property of highly irritating certain tissues in a morbid state. If admitted into the cavity of a carious tooth, it not unfrequently brings on a violent attack of toothache; and it was at one time thought to contribute directly to the destruction of the tooth; but this notion has, I believe, been satisfactorily disproved.

In the sick-room, sugar is often advantageously employed to correct foul odours, by being placed upon burning coals in a shovel, and thus carried around the apartment. I have noticed often, that it does not seem to act merely by covering disagreeable scents by its own agreeable odour; but that it permanently corrects them; from which it may be inferred, that some of the products of its decomposition exercise a chemical influence upon the unpleasant and unwholesome emanations, and that sugar may consequently be a real prophylactic agent.

In pharmacy sugar is used in the formation of many syrups, in the preparation of confections, as a flavouring and suspending medium in mixtures, and as an excipient in the pill mass.

Syrup (SYRUPUS, *U. S.*, *Lond.*; SYRUPUS SIMPLEX, *Ed.*, *Dub.*) is prepared by dissolving two pounds and a half of sugar in a pint of water. It may be used for most of the purposes above mentioned.

Syrup of Gum Arabic (SYRUPUS ACACIÆ, *U. S.*) is a solution of gum arabic and sugar, in which the latter ingredient greatly predominates; the proportions being two ounces of gum, fifteen of sugar, and eight fluidounces of water. Sufficiently diluted with water, this may be used for a demulcent drink; but it is more employed as a pharmaceutical agent in forming pills, and for the suspension of insoluble substances in mixtures. Half a fluidounce of it may be used in the preparation of a mixture of six or eight fluidounces.

II. MOLASSES.—SACCHARI FÆX. *Lond., Ed.*—THERIACA. *Dub.*

In relation to the two forms of molasses, and their laxative effects, see *page* 470. I allude to it here, merely to say that, like sugar, from which it differs not only by its impurities, but in being uncrystallizable, it is used as a demulcent drink in febrile and inflammatory complaints. It is often more acceptable to the palate and stomach, under these circumstances, than pure sugar, though also more liable to become acid in the stomach. I have found few drinks more agreeable in fever than very weak molasses and water, flavoured with lemon juice, with a piece of toasted bread introduced, and then cooled with ice. Solidified molasses is much used as a demulcent in coughs, being allowed slowly to dissolve in the mouth.

III. LIQUORICE ROOT.—GLYCYRRHIZA. *U.S., Lond., Dub.*—GLYCYRRHIZÆ RADIX. *Ed.*

Origin and Properties. *Glycyrrhiza glabra*, which is officinally recognized as the source of this root, is an herbaceous perennial, inhabiting the South of Europe, and in general the countries bordering on the Mediterranean, and cultivated in the more northern parts of the continent. It is supposed that another species, the *G. echinata*, which grows wild in the South of Italy, may contribute to the commercial supplies of the drug. It is brought to this country from different ports of the Mediterranean, and is derived chiefly from Sicily, Italy, and the North of Spain.

The dried root is in long, cylindrical pieces, about as thick on the average as the finger, wrinkled longitudinally, fibrous, of a grayish-brown colour on the surface, and yellow within. It yields a soft, loose, yellow or grayish-yellow powder. It has no smell, but a sweet, mucilaginous, somewhat acrid, and agreeable taste. Both water and alcohol extract its virtues. These, so far as the demulcent property is concerned, reside in a peculiar sweet principle, called *glycyrrhizin*. The principle upon which the acrimony depends has probably not been completely isolated; though an oleo-resinous matter has been obtained, having an acrid taste.

Glycyrrhizin is a yellow, transparent, very sweet substance, scarcely soluble in cold, but very soluble in boiling water, with which it gelatinizes on cooling, soluble in alcohol, and forming insoluble compounds with the acids. It differs from sugar in being insusceptible of the vinous fermentation. As it exists in the root, it is supposed to be rendered soluble by the presence of inorganic bases.

For the method of procuring it, see the U. S. Dispensatory. It is not medically employed in a separate state.

LIQUORICE (*Extractum Glycyrrhizæ*, U. S., Lond., Ed., Dub.) is obtained by boiling the root with water, and evaporating the decoction. Most of what is consumed in this country is imported from the Mediterranean; but considerable quantities are at present made here from the imported root. As brought from abroad, it is usually in cylindrical rolls often somewhat flattened, or in cubical masses, and is usually purified for medical use by solution in water, and evaporation. It is thus separated from insoluble matters, and in some degree also from the acrid principle; but it is doubtful whether the latter exemption is on the whole a merit, considered in a therapeutic point of view. Thus refined, it is in various shapes, sometimes in small cylindrical sticks about as thick as a pipe-stem, sometimes in flattened, lozenge-like pieces.

Liquorice is black, hard, brittle, with a shining fracture, a slight odour, and a peculiar, very sweet, somewhat acrid taste. With the exception of impurities, it is almost wholly soluble in water.

Medical Effects and Uses. Liquorice root and its extract are usually regarded as simply demulcent; but, from their usefulness in catarrhal affections, taken in connexion with their acrid taste, I am disposed to think that they are something more, and that, like seneka, they have a tendency to act on the pulmonary apparatus, and especially on the bronchial mucous membrane. The root is used in decoction, chiefly in connexion with acrid substances, which it is supposed to render milder through its demulcent properties, while it improves the taste. Thus, it is an ingredient in the officinal decoctions of mezereon and guaiacum, and compound decoction of sarsaparilla, and is very frequently associated with seneka. The powder is much used in the preparation of confections, and is an excellent excipient for liquids made into pills, as well as accompaniment for pills in the pill box. To the latter purpose it is adapted by its absorbent property, by which it prevents the pills from adhering together, while it gives them a coating not unpleasant to the taste.

The extract, commonly called liquorice, is much used for coughs, as well as to give flavour and demulcent properties to mixtures and lozenges, especially those used in bronchial affections. It is also often added to decoctions and infusions, with the same objects. Held in the mouth, and allowed slowly to dissolve, it alleviates cough, and, in chronic cases, or somewhat advanced stages of the

acute, operates, I believe, favourably on the disease, by an alterative influence on the diseased membrane. In cough mixtures, from half an ounce to an ounce may be added to eight fluidounces of the menstruum.

IV. GLYCERIN.—GLYCERINA. *U. S.*, *Dub.*

Origin. In the process of saponification, when a fixed oil and salifiable base react together, the oil is resolved into certain fatty acids, which combine with the base to form soaps, and into a substance which may be obtained separate, and which, from its sweet taste, has received the name of *glycerin*. For the precise method of preparing it, the reader is referred to the U. S. Dispensatory.

Properties. Glycerin is a liquid of the consistence and appearance of thin syrup, colourless or slightly yellowish, of an unctuous feel, inodorous, and of a strong, agreeable, and pure sweetness. It is heavier than water. One of its most remarkable and important properties is that it does not evaporate, and consequently retains its liquid form unchanged. A temperature sufficient to vaporize, decomposes it. At a full red heat, it is inflammable. Water and alcohol dissolve it in all proportions, but it is insoluble in ether. Its own solvent powers are very extensive, and will probably lead to its future use in medicine as a menstruum. It is antiseptic like sugar, but is not susceptible of the vinous fermentation. It appears to have basic properties. Its ultimate constituents are carbon, hydrogen, and oxygen; and, theoretically, it is a hydrated protoxide of a compound radical, called *glyceryle* (C_6H_7). In the oils, it is supposed to exist in combination with the fatty acids, without its equivalent of water.

Medical Effects and Uses. Like sugar, glycerin appears to be nutritive and demulcent; but is even blander in its effects on irritated surfaces than proper saccharine solutions. As a demulcent for external use, its essential liquidity renders it of great value, and places it, for some purposes, before all other substances of the class. It may not be so directly antiphlogistic as the aqueous solution of gummy matters; because the cooling effect of evaporation, and the direct sedative effects of the water are wanting; but, for preserving softness of tissue, and protecting against irritant influence from without, it is superior, or at least much more convenient; as it does not require the same constant watchfulness to prevent drying. Its introduction into use for this purpose is, I believe, due to Mr. Startin, of London.

In dryness of the ear, from deficiency or too great solidity of the cerumen, and consequent deafness, glycerin is an excellent remedy. I have found it equally useful in the annoying dryness of the mucous membrane of the nostrils, which is habitual with some, and is often connected with chronic inflammation. In either of these cases, it may be introduced by means of a camel's-hair pencil, or, in the case of the external meatus, upon raw cotton. In irritative cutaneous eruptions, it is an admirable remedy; being peculiarly adapted to *lichen*, *prurigo*, *herpes*, *eczema*, *psoriasis*, and *lepra*. But it may be used in any case of superficial irritation or inflammation of the skin, when a simple demulcent is wanted. It may also be added to cataplasms in order to keep them moist, and answers the same useful purpose in extracts and pills, which it also guards against mustiness. But a very small proportion must be used, or it will render the preparations too soft.

Glycerin has recently been proposed as an internal remedy by Dr. J. L. Crawcour, who has found it perfectly bland in its action on the animal economy, and possessed of the same property of supporting nutrition, and obviating the tuberculous and scrofulous tendency, which has given so much reputation to cod-liver oil. He gives from one to three drachms of it three times daily, in an ounce of water, in phthisis and strumous affections. (*N. J. Med. Reporter*, viii. 224, from *New Orleans Med. News and Hospital Gazette.*)

Some reference has been made above to its pharmaceutic uses. Its solvent properties promise to render it very useful as a vehicle for other medicines, whether to be taken internally, or applied to the surface. It dissolves generally the same substances as water, and some that water does not, and so also as regards alcohol. According to MM. Cap and Garot, it approaches closely in its solvent powers to diluted alcohol. Among the medicines which it dissolves in considerable proportion, and which are insoluble, or of difficult solubility in water, are *iodine*, of which it takes up one part in 100, *biniodide of mercury*, and *sulphate of quinia* which is dissolved by it as freely as by alcohol. *Strychnia* is soluble in 300 parts, *veratria* in 96, and *atropia* in 50; and all incomparably more so than in water. *Tartar emetic* is soluble in 30 parts. These are important facts, and suggestive of useful practical applications. (*Journ. de Pharm. et de Chim.*, 3e sér. xxvi. 81, Aug. 1854.)

3. *Amylaceous Demulcents.*

The substances belonging to this division are less demulcent than the preceding; but are occasionally used for this effect, and very much for nutritive purposes. They require notice, therefore; and I do not know where better to place them.

It will be most convenient, under this general head, to notice a few of the characteristic properties of *starch*, as a distinct proximate principle, which the physician must be acquainted with, in order to employ the amylaceous substances intelligently. We shall thus spare ourselves useless repetition in treating of the several preparations distinctly. *Starch*, when pure and unchanged, is white, in the form of a powder or of pulverulent lumps, inodorous and nearly tasteless, insoluble in cold water and in alcohol, but readily dissolved by boiling water, which retains a small proportion on cooling. If the boiling water has taken up more than can be held in solution upon cooling, the liquid assumes a soft, semifluid, gelatinous character. The starch that has thus been dissolved, continues afterwards, on being obtained in the dried state, soluble in cold water. Exposed to dry heat, starch undergoes a change which renders it partially soluble in cold water; and the same effect is produced in some degree by rubbing. These peculiarities are explained by the organic constitution of starch discovered by the microscope. It consists of minute granules, made up of concentric layers, the outer of which are insoluble in water, the inner soluble; so that, when exposed to heat, moist or dry, the outer coating is ruptured, and water, being enabled to penetrate the interior, comes into contact with the soluble portion, and dissolves it. Starch is characterized by forming a deep blue compound with free iodine. Like sugar and gum, it consists of carbon combined with hydrogen and oxygen in the proportion in which these principles unite to form water. The different kinds of starch have granules of a peculiar and characteristic formation, by which the varieties may be distinguished.

I. WHEAT STARCH.—AMYLUM.—*U. S., Lond., Ed., Dub.*

The reader is referred to the U. S. Dispensatory for an account of the mode of preparing this substance, and of its peculiar sensible and chemical properties. In decoction, it is used chiefly as a vehicle for substances given by enema, when it is desirable as much as possible to obtund their acrimony, and thus enable them

to be retained. It may also be used alone, as an injection, in order to allay irritation of the rectum by its demulcent property. In the powdered state, it is sometimes dusted over irritated surfaces, to prevent excoriation, and absorb acrid secretions. In cases of poisoning from free iodine, starch should be introduced freely into the stomach as an antidote.

Mucilage of Starch (MUCILAGO AMYLI, *Ed. Dub.;* DECOCTUM AMYLI, *Lond.*) may be prepared by boiling for a short time three or four drachms of the starch in a pint of water. It has a whitish gelatinous appearance on cooling. When it is given by injection, as a vehicle for laudanum, one or two fluidounces may be used at once; when as a mere demulcent, from four fluidounces to a pint.

II. ARROW-ROOT.—MARANTA. *U. S., Lond., Ed.*—MARANTA ARUNDINACEA. *Dub.*

Origin and Properties. This is obtained from the root or rhizome of *Maranta arundinacea*, and other species of Maranta, herbaceous perennials, growing in the West Indies, where, as well as in our own southernmost States, they are cultivated for the sake of this product. It is prepared by agitating the bruised roots with water, which holds the separated starch in suspension, and which, being strained, and permitted to stand, deposits the powder. This being washed and dried in the sun, constitutes the arrow-root of the shops. It is in the form of a fine white powder, or easily pulverized lumps, very light, and having all the properties of starch, of which it is a very pure specimen. It should be free from smell or taste.

Medical Uses. Arrow-root is used more for food for the sick than as a demulcent, though, while performing the former office, it also frequently does good incidentally in the latter capacity. Its perfectly bland, and moderately nutritive properties, fit it for use in febrile and inflammatory diseases, especially in approaching convalescence, and in irritated states of the stomach and bowels. It is used in infantile cases, and not unfrequently as a digestible article of diet for healthy children after weaning, or when insufficient milk is afforded by the nurse. A tablespoonful is sufficient for a pint of water. The powder should first be mixed with a little cold water, and afterwards stirred with boiling hot water. On cooling it forms a whitish gelatinous solution. If the arrow-root is added largely, a solid jelly-like mass results. The powder is often also boiled with milk, or with a mixture of milk and water, as a diet for children and the sick, when support is required, as in typhoid cases, and in convalescence. Sugar or molasses, lemon-juice, or, if

not contraindicated, a little wine may be added to the pure aqueous solution, to improve its flavour.

Several other forms of starch, procured from different sources, and having more or less of the appearance, and sometimes bearing the name of arrow-root, have been substituted for it; but it is rare to find any one so pure, and so free from all unpleasant taste. Among these may be mentioned purified *potato starch;* a preparation made in the South Sea Islands from a species of Tacca, called the *Tacca arrow-root;* and the *tous-les-mois* or *canna*, from an undetermined species of Canna, supposed to be *C. coccinea*, growing in the West Indies. The last mentioned is a very fine variety of starch, and may be used for the same purposes, and in the same manner as arrow-root.

III. SAGO. *U. S., Lond., Ed., Dub.*

Origin and Properties. Sago is prepared from the pith of the stem of an East India palm, called *Sagus Rumphii*, and probably other trees of the same family. The stem is cut into billets, which are split; and the pith extracted from it is agitated with water, so as to separate the starch. This being suspended in the water, subsides when the latter is poured off, and allowed to rest. The moist paste thus procured is rubbed into grains and dried. This constitutes the common sago. It is produced in great abundance in the Moluccas, and other East India Islands. At Malacca and Singapore, it undergoes a refining process, and is converted into what is called in commerce pearl sago. The latter must be exposed to heat in its preparation, as it is partially soluble in cold water.

Common sago is in grains of varying size, the largest scarcely so large as a small pea, of a whitish, grayish, or brownish-gray colour, often mixed with a grayish powder, and more or less impure. *Pearl sago*, which should be chosen for medical use, is in hard, round grains, of more uniform size, about as large as the head of a pin, of a lighter colour, but not perfectly white, often somewhat translucent, bright, and clean. Both varieties consist almost exclusively of starch; the common sago being quite insoluble in cold water, the pearl slightly soluble from the cause above mentioned.

Medical Uses. Sago is employed exclusively as an article of diet, and for this purpose is very useful in low fevers, and convalescence from acute diseases. In consequence of its hardness, it requires to be boiled for some time to effect a complete solution; and, as it is given generally in a feeble condition of the digestive organs, care

should be taken that the grains are completely broken up, so as to facilitate digestion. From half an ounce to an ounce may be boiled in a pint of water, according to the richness of the preparation wanted. A tablespoonful is ordinarily sufficient. The liquid should be constantly stirred during the process; and, if any hard grains remain, they should be separated by straining. Sugar and lemon-juice may be added if desired, and a little wine and nutmeg in feeble states of the system.

IV. TAPIOCA. *U. S.*, *Ed.*, *Dub.*

Origin and Properties. This is the product of Janipha Manihot, the *mandioca* or *cassava plant*, a shrubby plant, indigenous in S. America, where, especially in Brazil, it is largely cultivated for food. There are two varieties, one the sweet, the other the bitter cassava, of which the latter, though its root is poisonous in the recent state, is most largely cultivated on account of its productiveness. By exposure to heat, however, the poisonous properties, which have been ascribed to hydrocyanic acid, are entirely dissipated, and the root becomes perfectly safe. It is used in various ways, and enters largely into the diet of the people. Tapioca is obtained by expressing the root. The liquid thus obtained, being allowed to stand, deposits starch, which is washed, and afterwards prepared by exposure to heat.

It is in irregular, very rough, hard, white grains, inodorous, of a very feeble taste, and with all the properties of starch; being, however, slightly soluble in cold water, in consequence of the heat used in its preparation.

Medical Uses. Its uses, and mode of preparation are so exactly the same as those of sago, that nothing more is necessary than to refer to what was said of that form of starch.

V. PEARL BARLEY.—HORDEUM.—*U. S.*, *Lond.*, *Ed.*, *Dub.*

Origin and Properties. Pearl barley consists of the grains of common barley, or fruit of *Hordeum vulgare* and *H. distichon*, deprived of their exterior coating, and smoothed and polished in a mill. They are small oval bodies about a line in length, with a longitudinal mark on one side, smooth, and white. Pearl barley contains a large proportion of starch, with a little gum and sugar, which it yields to boiling water.

Medical Uses. The decoction of barley, or *barley water*, as it is commonly called, is very much used, as a bland, demulcent, and sufficiently nutritive drink, in febrile and inflammatory diseases, and

fully deserves its reputation. Some care is requisite, in its preparation, to guard against mustiness, or other source of unpleasant taste, or irritant effect; as its chief merit depends upon its being acceptable to the palate and stomach.

The officinal *Decoction* (DECOCTUM HORDEI, *U. S.*, *Lond.*, *Dub.*) is prepared by taking two ounces of pearl barley, washing it well with cold water, which is to be thrown away, then boiling it for a little while with half a pint of water, which also is to be thrown away; and lastly boiling the grains thus purified with four pints of water down to two. Every physician should be familiar with this process, so as to be able to give proper instruction to nurses. It may be flavoured with sugar, &c. if desired.

A *Compound Decoction* (DECOCTUM HORDEI COMPOSITUM, *Lond.*; MISTURA HORDEI, *Ed.*) is prepared by adding to the two pints of simple decoction prepared as above, two ounces of figs, half an ounce of bruised liquorice root, two ounces of stoned raisins, and a pint of water, then boiling to two pints, and straining. The decoction is thus rendered more nutritive, more demulcent, and more agreeable to the taste; but could not be given so freely in a very delicate condition of the stomach.

VI. ICELAND MOSS.—CETRARIA. *U. S.*, *Lond.*, *Ed.*—LICHEN ISLANDICUS. *Dub.*

Origin and Properties. *Cetraria Islandica*, or Iceland moss, is a small plant, from two to four inches high, growing in the northern regions of Asia, Europe, and America, and abundant in some parts of New England. The whole plant is used. It consists of a dry, stiff frond or leaf, much divided, irregular in shape, and in the original state fringed with hairs upon the edges, most of which, however, have been lost as it is found in the shops. The colour is a mixture of different hues, irregularly dispersed, grayish-white, brownish, and reddish; there is no odour; and the taste is bitter and mucilaginous. The moss imparts all its virtues to boiling water. The important constituents are a starch-like substance in large proportion, constituting about 45 per cent., and a bitter principle amounting to 3 per cent. There is, besides, a little gum and sugar. The starch-like substance is insoluble in cold water, but is extracted by boiling water, and gelatinizes on cooling. In these respects it resembles starch, as also in producing a blue colour with iodine; but, as it differs in some other points, it has been called *lichenin*. The bitter principle is named *cetrarin*. It may be separated by

macerating the plant in a very feeble solution of carbonate of potassa, which leaves the nutritive and demulcent principle, to be afterwards extracted by boiling with water. Prepared in this way, the moss is used as food, in times of scarcity, by the poorer population of some northern regions.

Medical Effects and Uses. Iceland moss unites gentle tonic with its nutritive and demulcent properties, and has consequently been employed in cases offering indications for these two effects, as, in *chronic pectoral affections with hectic symptoms, chronic dysentery and diarrhœa*, and *dyspepsia*. Much was at one time hoped for, in phthisis, from a diet consisting mainly of a decoction of the moss; but experience has falsified all such expectations. It may be advantageously employed with a view to its tonic, nutritive, and demulcent effect; but this is all. It has been proposed to deprive it of its bitter principle, and then prepare it by decoction; but it thus loses the tonic property, and becomes a simple demulcent article of diet, in no respect superior to most of the class, and inferior to many. It is used almost exclusively in decoction.

The officinal *Decoction* (DECOCTUM CETRARIÆ, *U.S.*, *Lond.*) is made by boiling half an ounce of the moss in a pint and a half of water down to a pint, of which the whole may be taken, in separate doses, in the period of twenty-four hours.

VII. IRISH MOSS OR CARRAGEEN. — CHONDRUS. *U. S.*

Origin and Properties. This is the *Chondrus crispus* (*Fucus crispus*, Linn.), which grows on rocks and stones on the sea coasts of Europe, and in peculiar abundance on the Atlantic shore of Ireland, where it is chiefly gathered. It consists of a slender frond, sometimes a foot in length, gradually expanding as it ascends to a width of two or three lines, then dividing and subdividing into linear lobes, and often much curled in the direction of its length. It is translucent, of a cartilaginous consistence, a yellowish or yellowish-white colour, a slight odour, and a peculiar but feeble taste, recalling that of sea plants in general. It swells and softens with cold water, but does not dissolve. Boiling water extracts nearly 80 per cent. of a principle analogous to pectin, but somewhat peculiar, for which the name of *carrageenin* has been proposed. Minute quantities of iodine and bromine have been detected in it; but their presence is doubted by some, and they can scarcely add appreciably to the virtues of the moss.

Medical Effects and Uses. Irish moss is simply demulcent and nutritive, and may be used for the same purposes as the amylaceous

substances already described, over which it has little if any advantage. It has been recommended in pectoral diseases, scrofulous complaints, and chronic diseases of the bowels and urinary organs, under the impression that it possessed special virtues; but time has fixed its value as above stated. It is prepared in decoction by boiling an ounce in a pint and a half of water to a pint, and flavouring to suit the taste. It is often also boiled with milk, when the latter is thought to be indicated. No doubt, an exclusive diet of Irish moss with milk would prove extremely useful in many cases of disorder of the bowels. In order to remove adhering substances which may injure its flavour, it should be steeped, for a few minutes, in cold water before the decoction is prepared.

VIII. SWEET ALMONDS.—AMYGDALA DULCIS. *U. S.*, *Ed.*—AMYGDALA. *Lond.*, *Dub.*

These are too well known to require description. I introduce them here, as an excellent demulcent, well calculated for pectoral and bowel affections, in which this class of medicines is indicated. Though they contain no starch, and but a small portion of sugar and gum, yet they abound in albumen and fixed oil, which jointly operate quite as advantageously as the other demulcent principles mentioned. These two principles they yield to cold water rubbed up with them, forming a fine white milky emulsion, of an agreeable flavour, in which the albumen is dissolved and the oil held in suspension by the former principle. This emulsion may be used externally, as a lotion, in irritated and inflamed states of the skin, and may be taken internally in irritative affections of the bowels, urinary organs, and bronchial tubes. It serves admirably as a vehicle for expectorant medicines; but as it does not keep well, it must be prepared frequently, as wanted.

The *bitter almonds* form a similar emulsion, but superadd the effects of hydrocyanic acid, which render them still more useful in pectoral and cardiac diseases, and for external use, in irritable conditions of cutaneous disease.

Almond Emulsion or *Almond Mixture* (MISTURA AMYGDALÆ, *U.S.*, *Lond.*, *Ed.*, *Dub.*) is made by macerating half an ounce of sweet almonds in water, to facilitate the removal of the skin, after which they are to be beaten thoroughly in a mortar with half an ounce of gum arabic and two drachms of sugar, and the whole rubbed with half a pint of distilled water, gradually added. The emulsion is then to be strained. A pint or more of this may be taken in twenty-four hours, in doses of a wineglassful or teacupful.

A similar mixture may be made with bitter almonds, and a tablespoonful given for a dose, in pectoral and cardiac complaints.

IX. WHEAT BRAN. — TRITICI FURFUR.

Bran contains a little starch, albumen, and probably gum, which it yields to water, forming a mucilaginous infusion, which may be used for general baths, with advantage, in cutaneous affections. I have frequently employed the remedy in these cases, and have had reason to be satisfied with its effects. From half a peck to a peck of the bran may be put in each bath, of which the water may be heated to 95° or 100°, according as the affection may be acute or chronic.

CLASS III.

EMOLLIENTS.

EMOLLIENTS, as here considered, are substances capable of forming a soft, slightly adhesive mass, perfectly bland and unirritating, which, when applied to the skin, has the effect of softening and relaxing its tissue. I confess that there is no very distinct line of demarcation between this class and that of the demulcents; and one of the methods, by which the medicines belonging to it act usefully in disease, is that which characterizes the succeeding class of protectives. Yet there are points of difference sufficient, I think, to justify a retention of these agents in a distinct and long recognized association. Thus, emollients, as here defined, have definite limits of action, and are exclusively external. Demulcents may be used to any extent upon the surface, and are frequently used internally. One of the main offices performed by the demulcents is to mingle with acrid substances, and diminish or obtund their acrimony. This office cannot be performed by the emollients. These have a deeper effect upon the tissues than the demulcents, which for the most part operate upon the surface of application exclusively. On the other hand, the emollients differ from the protectives in the softening and relaxing effect produced by the moist or liquid matter incorporated with them, while they may be less efficient upon the mere principle of excluding the air, which they do but partially.

So far as they are a distinct class of remedial substances, the emollients are merely the recipients of the fluids, which are the real agents in all the dynamic results produced. Thus, flaxseed meal is an emollient; but it is the liquid that may be mixed with it which really produces the effects. There are only two liquids which have this property; *water*, namely, and *glycerin*. The fixed oils often form a part of the emollient application, calculated to give it the due consistence, and therefore belong to the class; but the oils alone are inadequate to the effects aimed at. No one would expect the influence exercised by emollients, from a mixture of one of the fixed oils with sawdust. Water is almost always the active principle; and the substances here called emollients merely

afford the means of applying it in the required method. Glycerin has probably the same or very similar powers with water; but experience has not determined the point definitively.

The emollients are employed in the form of poultice or cataplasm. Water, by means of them, is confined within certain limits, at the temperature of the body, and is steadily thus applied, for a considerable length of time, so as to be able endosmotically to penetrate the tissues, and to an indefinite depth. The water, thus present in the tissues, in excess, exercises its sedative influence upon them, reduces their vital force, and diminishes their action. Perhaps its presence between the molecules, by somewhat separating them, lessens their vital cohesion by a kind of mechanical influence. But, however the effect may be produced, it is the water that produces it. The fixed oils are incapable of thus acting. They cannot sufficiently penetrate the tissues.

Under the operation of one of these emollients, the parts beneath often swell considerably, and become obviously soft and flaccid to the touch. If applied over a wounded or abraded surface, by a long continuance, they will produce so flabby a condition as to favour the production of fungous granulations.

As therapeutic agents, they are useful chiefly, if not exclusively, in inflammation or vascular irritation; and they prove curative in these cases mainly by their sedative agency. If the inflammation of parts beneath has advanced to a certain stage, they often hasten suppuration. This they do simply by diminishing the vital force in the inflamed part, in consequence of which the exuded fibrin, instead of undergoing organization, perishes, and is converted into pus. By thus promoting the formation of abscesses, they often hasten the cure. But, in the earlier stage, or when the violence of the inflammation falls short of the suppurating point, they favour its resolution by direct sedation. In mere vascular irritation, which has not yet amounted to inflammation, they will be even more effective in putting an end to the affection. Hence the use of emollient poultices in all superficial inflammations, whether idiopathic, or the result of a wound, or any other kind of injury. Their action extends also to the subcutaneous tissue. Hence their universal employment in boils and phlegmons. The inflamed lymphatic glands feel the same influence; as also do the arteries, veins, and absorbents of the extremities. The secreting glands outside of the great cavities are equally benefited. Emollient

poultices, in inflammation of the testicles, and of the salivary glands, often produce the most happy antiphlogistic effects.

But what shall we say of their influence over inflammation of the tissues within the cavities? I agree with those who believe that they are very efficient auxiliaries to other antiphlogistic remedies, in these cases, at least in many of them. In pleurisy, peritonitis, enteritis, gastritis, dysentery, and bronchitis, I believe they exercise very happy effects. But they must be very large, retained steadily for days, and frequently renewed so as to be always kept moist. Thus, in peritonitis and enteritis, the whole anterior surface of the abdomen should be covered. I can conceive that, in these cases, the water may enter the vessels and dilute the whole blood, by affecting that which is circulating through the vessels beneath. I have no doubt that pediluvia do act upon this principle to a considerable extent; and so may poultices. But that cannot be the main agency: as otherwise poultices to the extremities should have the same effect. Their effects in internal inflammations may be explained in two ways. The mucous surfaces sympathize with the skin, and may, when inflamed, feel a sedative influence exerted upon the surface of the body. As regards the serous tissues, which are in contact with the walls of the cavity, the water may possibly reach them from the surface, and thus act on them directly. In relation to inflammation of the parenchymatous tissues, I do not think the poultices are so effectual as in those of the membranes. Certainly, either of the explanations just given would not so well apply to them.

But these emollient cataplasms may be continued too long. They should always be discontinued, when the sedative effect becomes the prominent evil; and sometimes, in such cases, a stimulant application will speedily correct the evil. Thus, after the use of poultices in ordinary paronychia, the end of the finger affected often swells much, assumes an almost mush-like consistence, and, if an incision has been made, fungous granulations are apt to shoot up out of the wound. I have found that the withdrawing of the poultices, and the application of resin cerate, with a spirituous lotion, have immediately restored energy to the parts. Nor should emollient poultices be applied in cases of inflammation, in which suppuration is threatened, or liable to occur, but in which, nevertheless, it may be very desirable to prevent it.

The degree of consistence in the emollient application has been indicated in the definition. It should be so soft as readily to adapt

itself to the shape of the surface, yet so consistent as to retain its form, and not run. The fixed oils added to poultices are often useful by retaining the softness, particularly about the edges, where they are most apt to become dry, and thus prove irritating to the part. I believe glycerin is still better than the oils, as, in addition to the effect aimed at, it may possibly be absorbed, and aid the water in its action on the tissues.

Of the substances used as emollients, all or nearly all have been already treated of, and, if not, the material is so common and well known as to require no description. Little more, then, is required here, than to name the substances used, and give, in relation to each one, such practical hints as may suggest themselves.

1. Bread and Milk.—For application to small extents of surface, as in furuncles, paronychiæ, buboes, &c., these are on the whole as convenient as any other materials, being almost always at hand, and easily prepared. The poultice is made by simply crumbling the bread, and heating it with milk, stirring constantly until the two are thoroughly incorporated. Care should be taken to use sweet milk, as it is somewhat irritant when soured. A little perfectly bland olive oil, or sweet lard without salt, may be added, to retard the drying of the poultice, but they do not add to its emollient virtues.

2. Flaxseed Meal.—*Lini Farina.* Ed.—The Edinburgh College directs the meal of flaxseed, previously deprived of its fixed oil by expression. This contains a large proportion of gummy matter or mucilage, and will make a good cataplasm; but the oil has the advantage of keeping the poultice longer in the proper soft condition, partly through its own fluidity, and partly by mechanically retaining the water. The meal of the unexpressed seed is, therefore, preferable. It is obtained by grinding. The cataplasm is made by adding the meal gradually to boiling water, till it is sufficiently thickened. About four ounces are required for half a pint of water. The flaxseed cataplasm is one of the best that can be used, if made out of meal that has not become acrid by keeping.

3. Slippery Elm Bark.—*Ulmus.* U. S.—The ground slippery elm bark, in consequence of the abundance of its mucilage, forms an excellent emollient cataplasm, prepared exactly in the same manner as that of flaxseed meal. The ground bark is a loose, very light, coarse powder, in which, along with a fine dust, there are

many fibres not completely pulverized. I have been told that many persons sift the powder, retaining the finer for internal, and the coarser for external use. This is wrong. The whole powder should be used in the formation of poultices, as likely to be more completely unirritating to delicate surfaces. Some bland fixed oil, incorporated with this cataplasm, might be useful, by longer preserving its softness.

4. MARSHMALLOW ROOT.—*Althææ Radix.* U. S., Ed.—*Althæa.* Lond.—Boiled and thoroughly beaten up with water, this root forms an emollient poultice, sometimes employed in Europe. It is seldom if ever used here.

5. OATMEAL.—*Avenæ Farina.* U. S.—If oatmeal be gradually added to boiling water until it assumes the consistence of a thick paste, it forms an excellent emollient cataplasm.

6. INDIAN MEAL.—*Zeæ Farina.*—*Indian mush* is much used, in this country, where large cataplasms are required, as, for example, to cover the anterior surface of the abdomen, or a large portion of the chest. The poultice is made, as the others, by adding Indian meal gradually to boiling water, and stirring until the proper consistence is obtained.

7. Most of the *roots of ordinary edible vegetables* may be used for the same purposes. POTATOES, TURNIPS, and CARROTS are most frequently used. They are thoroughly boiled, and then mashed into a pulp. The unboiled *carrot root* has also been recommended; but this is not strictly emollient, being somewhat excitant in consequence of the presence of a little volatile oil. In this state, however, it sometimes answers a good purpose in indolent and flabby ulcers, by gently stimulating them, and will sometimes cause the ulcers which follow burns to heal kindly.

Whatever substance is used in preparing emollient cataplasms, it will often be advisable to cover the surface of the poultice with a piece of gauze, and stitch the edges of this to those of the outer covering, in order to prevent the escape of the material. When the poultice is applied over the eye, the external meatus of the ear, or a wound of irregular surface, this precaution is peculiarly necessary.

CLASS IV.

PROTECTIVES.

THIS name I give to remedies, which, applied to a diseased surface, protect it from the contact of the air, and of irritant agents generally. I do not insist upon the name, but know no other word in our language which would better express the idea; and I am averse to the invention of new words when not essential. In relation, however, to the class itself, there seems to be a necessity for it in a system of arrangement, which is to embrace all therapeutic agencies. Other classes may include substances which act on this principle; and the operation of certain classes necessarily implies a certain amount of protective influence, as of the demulcents and emollients; but there are substances used for this purpose which cannot be introduced elsewhere, and, in regard to the two classes mentioned, the protective influence is but partial.

The therapeutic effect of the protective operation is to aid in the cure and prevention of inflammation. This is its characteristic aim and object. That the measure has such an influence, and one of no little efficacy, is shown by daily experience and observation. We constantly witness the efforts of nature to avail herself of this therapeutic principle. She covers small sores with a scab, upon the falling off of which, the surface is found to have healed beneath it. In extensive vesications, if, upon the escape of the liquid, the epidermis lies undisturbed in contact with the surface, the inflammation generally ceases, and a new cuticle soon forms; whereas, if the protection of the cuticle be removed, the denuded surface is very apt to become still more inflamed. It has already been stated that the best dressing for a blister, which it is desired to heal, is the cuticle as nearly unbroken as possible. When such protection is impracticable, nature endeavours to supply the place, either by the production of pus, which answers the purpose partially, or by throwing out a layer of coagulable lymph, which produces a still greater protective effect. We every day see slight inflammation, spontaneous or accidental, yield to the simple application of a piece of court-plaster, which, without such protection, would often advance and prove very annoying. In recent times, we have had

abundant opportunities of witnessing the same effect, from the application of collodion and similar agents.

Upon what principle do these agents operate? So far as concerns the protection they afford against mechanical injury, as from friction, sand, dust, &c., or known dynamical irritants, or even changes of temperature, their influence is intelligible. They obviate the effects of these irritant causes, and, in cases of existing inflammation, enable nature to effect a cure. But this is not all they do.

It is obvious that they act advantageously also by excluding the atmospheric air; for, if this is admitted, the exclusion of all other agents often proves quite unavailing. But the air is not in itself irritant. We are always surrounded with it; we are constantly inhaling it even down to the delicate vesicular tissue of the lungs; it is probably never entirely absent from the alimentary canal; it has often found its way into serous cavities and the areolar tissue; and yet inflammation is not observed to result from it, under these circumstances. The air is perfectly bland. Some have explained the result by reference to the drying influence of the atmosphere, which produces a condition of things in denuded, wounded, or ulcerated surfaces, which strongly tends to excite or sustain inflammation. There is, no doubt, truth in this explanation. The protectives certainly do good in this way, in diseased and uncovered surfaces. But it very often happens that such surfaces may be kept abundantly moist, so as entirely to obviate the drying effect of the air, yet without improving; whereas, if completely protected against the contact of the air, they quickly begin to amend, and soon heal entirely. The same effect, moreover, is observed from the protectives, in diminishing inflammation upon surfaces with the epidermis or epithelium sound, and when moisture or dryness forms but a small part of the consideration in the case. There must be some other method of accounting for the effect. The following appears to me to be the most satisfactory explanation.

Though the air is bland in its ordinary influence in health, it is because a due balance is observed between its dynamic properties and the requisitions of the system. The air is always performing important functions, not only in the lungs, but upon the surface of the body, and probably in the alimentary canal. It is always supplying oxygen and receiving carbonic acid. This is certain in relation to the air-passages; has, I think, been proved in relation to the skin; and is fairly inferrible to be true also in the alimentary canal. In the healthy state, it imparts enough oxygen, and receives enough carbonic acid, to meet the wants of the system;

and nothing more happens than the regular maintenance of the systemic functions. But, when inflammation is established in any portion of the great surfaces, with which the air is in contact, as it consists in, or is attended with an elevation of the vital functions, more air is required to support the excited process. More oxygen is consumed, more carbonic acid formed, and more heat evolved. A portion of this oxygen the inflamed surface receives from the contiguous air. If, therefore, we exclude this air, we cut off one source of the pabulum necessary for the support of the inflammatory process, which consequently diminishes or ceases. It may be said to die for want of aliment. This is a simple explanation, and it will, I think, apply to all the problems that can be presented in the case. The presence of the air supports the inflammation; remove it, and the inflamed parts must then depend for their supply of oxygen solely on that brought with the blood from the lungs; and, though it does not necessarily follow that the inflammation must cease, when the local supply of air is cut off, especially after fever has set in, by which the movement of the blood is accelerated, yet one influence is certainly added to those which favour the reduction and resolution of the inflammatory state.

Nor is this influence confined to inflammations entirely superficial. It enters, for a considerable depth, into the tissues; and subcutaneous inflammation, as in the cellular tissue, muscles, and lymphatic glands, is often much relieved.

There are two objects in the use of protective measures; one to prevent, the other to cure inflammation. When a part is liable to be injured by friction, or by irritating liquids, we cover it with the view of obviating injury. Thus, bed-sores are prevented by lead-plaster, applied over the parts exposed to injury, and surfaces liable to the action of irritating secretions are guarded by covering them with some stiff unctuous substance. But the therapeutic effect is that for which the class is mainly used.

The protective agents are of two kinds; one operating of themselves, the other through changes produced in the surface of application. The former are purely mechanical, simply serving, by their presence, to exclude irritating agents; the latter at first act dynamically or chemically on the tissues, the surface of which they so alter as to render it insensible to irritants, and impervious to the air; and a portion of the tissue itself is thus made to protect the remainder. The one kind are direct, the other indirect protectives.

Court-plaster, or collodion, is an example of the former; nitrate of silver, or iodine, of the latter. I shall consider them in these two divisions.

1. *Direct Protectives.*

This division includes all substances, themselves inert, which are employed to cover exposed surfaces, so as to guard them against irritating agents. It is obvious that they must be themselves wholly unirritating; as otherwise, they would directly contribute to produce or increase what they are intended to prevent, diminish, or remove. Hence the great practical importance of ascertaining that the substances used are pure, and uninjured by exposure, fraudulent admixture, or careless preparation. The physician is often foiled in his purpose by want of attention to this object.

I. OLEAGINOUS SUBSTANCES.

Under this head, I include both liquid oils and fats, together with wax, as of closely analogous nature. Of the origin, preparation, and physical and chemical properties of these bodies, I shall say little or nothing; as they are generally well known, and if the reader desire information, he will find it in the U. S. Dispensatory.

Of the liquid oils, those usually employed are the olive oil and almond oil; of the fats, lard, suet, and spermaceti, including wax. Others are occasionally used; but none which produce effects different from those attainable through the particular substances above mentioned. Whatever may be popularly thought upon the subject, there is nothing peculiar or specific in the operation of *goose-grease*, *rabbit's fat*, *bear's grease*, or even the fat of serpents.

1. **OLIVE OIL.** — OLEUM OLIVÆ. *U. S., Lond., Ed., Dub.*

ALMOND OIL. — OLEUM AMYGDALÆ. *U. S., Lond.*

These oils, of which the former is procured by expression from olives, the latter in the same manner from sweet almonds, may be considered, in their protective capacity, as identical in their properties and uses. They are both nutritious, and both in large doses mildly laxative; but with these properties at present we have nothing to do. The olive oil, as the least costly, is most frequently used.

Rubbed up with mucilage or the yolk of eggs, and loaf sugar, they form an emulsion, which, by sheathing the mucous membrane of the mouth and fauces, may prove useful in allaying cough, and moderating the uneasiness of stomatitis and angina. Almond oil

is usually preferred for this purpose. A fluidounce may be rubbed with half a fluidounce of mucilage of gum arabic or the yolk of an egg, and two drachms of loaf sugar, and then mixed with five or six fluidounces of water.

They are sometimes applied, unmixed, to dry, harsh, cracked or excoriated, and inflamed or irritated surfaces, to soften and protect them; but much more frequently they are used for this purpose in combination with substances, such as wax or spermaceti, which give them more consistence. These combinations will be specially noticed in their proper places. Olive oil, rubbed over the surface of the body, is thought, in the East, to be both a preventive and remedy of the plague.

Very often these oils are employed to serve as a vehicle for other substances, which they also dilute when too acrid; but this application of them has been noticed under the several substances with which they are thus associated.

A mixture of equal parts of olive oil and lime-water, forming a kind of soap, is much and advantageously used as a dressing for burns and scalds, at their first occurrence. There is probably no better application for the first two or three days. It should be thickly applied, on cloth, so as thoroughly to cover the whole surface. The U. S. Pharmacopœia directs *flaxseed oil* to be used, and it has the advantage of greater cheapness, but no other, and is rather less agreeable.

2. LARD. — ADEPS. *U. S.*, *Lond.* — AXUNGIA. *Ed.*, *Dub.*

This is the prepared fat of the hog. When used as a protective, it should contain no common salt, and must be perfectly free from rancidity. It need scarcely be stated that lard taken internally is highly nutritious. Its use as an ingredient of laxative enemata has been already mentioned.

Alone, it is more frequently used as a protective to irritated surfaces than the liquid oils; and is sometimes, especially in cold weather, applied as a dressing to wounds and blisters; but it is too diffluent, at the temperature of the body, to be used advantageously for this purpose, unless incorporated with some firmer material.

Lard has recently attracted much attention, and been extensively used, as an external remedy in scarlet fever. It was introduced into use for this purpose by Dr. Schneemann, of Hanover, Germany, who employs it in the form of fat bacon. The whole surface, excepting the scalp and face, is rubbed with it night and morning. I have not used the remedy; but have been informed by medical friends that they have found it very successful; and favourable

reports of it have been published. It probably acts by protecting the surface against the oxygenizing influence of the atmosphere, which may be necessary, or at least greatly contribute to the maintenance of the eruption.

The preparations in which lard is chiefly used as a protective agent, will be mentioned directly. Like olive oil, it is much employed as a vehicle or diluent of acrid or irritant substances.

3. **SUET.**—SEVUM. *U.S.*, *Lond.*, *Ed.*

Suet is the prepared fat of the sheep. It has the same properties as lard, from which it differs mainly in being of a firmer consistence. The only objection to its use is its liability to become rancid, in which condition it is decidedly irritant; and it should never be employed except when perfectly sweet. In this state, it forms an excellent protective dressing for blisters, ulcers, wounds, and abraded surfaces, and those liable to be irritated or excoriated by acrid secretions; as the upper lip, for example, in coryza. It is also used to give a firmer consistence to ointments, prepared with lard or olive oil, as in the instance of mercurial ointment.

4. **SPERMACETI.**—CETACEUM. *U.S.*, *Lond.*, *Ed.*, *Dub.*

This is obtained from the fat in the head of the spermaceti whale. For use in medicine it should be of the finest quality, white, pearly, translucent, without unpleasant odour, and quite destitute of taste. It is used almost exclusively to give proper consistence to ointments and cerates, and, with lard and olive or almond oil, forms excellent protective combinations.

OINTMENT OF ROSE WATER (*Unguentum Aquæ Rosæ*, U.S.), commonly called *cold cream*, is an officinal of the U. S. Pharmacopœia, and an excellent preparation. It consists of rose-water, almond oil, and spermaceti, with a very small proportion of white wax. There is no unctuous preparation better adapted to excoriated and irritated surfaces, especially chapped hands and lips. Persons whose hands are liable to be chapped in winter, cannot do better than, after each washing of the hands with soap and water, to rub them over thoroughly with this ointment, and then carefully wipe them off, without again introducing them into water. The skin is thus preserved sound and soft, and much vexation and inconvenience avoided. It is the plan I have adopted during my hospital duties, and always found effectual. The rose-water gives a pleasant smell to the preparation. It should be frequently renewed, as, if kept, it is apt to become rancid, and unfit for use. Another method of accomplishing the same object in relation to the hands,

when chapped, is every night, at bedtime, to rub them thoroughly with perfectly sweet oil or lard, to sleep with them gloved, and next morning to wash them with soap and water.

SPERMACETI CERATE (*Ceratum Cetacei*, U.S., Lond.) is made by melting together spermaceti, white wax, and olive oil. When the ingredients are pure and sweet, it forms an excellent dressing for blisters, excoriated surfaces, wounds, and ulcers, when the object is not to make any specific impression on them, but merely to favour their healing by protecting them from the air, &c. The cerate is often also used as a vehicle for substances applied with other objects.

5. YELLOW WAX.—CERA FLAVA. *U.S., Ed., Dub.*

WHITE WAX.—CERA ALBA. *U.S., Lond., Ed., Dub.*

These are varieties of *bees-wax* (cera); the yellow being the crude wax as prepared from the comb; the white, the same purified by a bleaching process, which deprives it of colouring and odorous matter. The white wax is that usually preferred in the preparation of ointments, cerates, and plasters, for which purpose it is much used. Its advantages are that it is perfectly bland, and, by its physical properties, serves to give a proper consistence and tenacity to the preparation. The protective compounds, of which it is an ingredient, are the *ointment of rose-water* and *spermaceti cerate*, just described, and the following.

SOAP CERATE (*Ceratum Saponis*, U.S.) is made from a solution of subacetate of lead, soap, white wax, and olive oil. The solution of the salt of lead is first boiled with the soap, and after due concentration is incorporated with the wax and oil melted together. In the first part of the process the fatty acids of the soap unite with the protoxide of lead, forming the proper lead plaster, while the acetic acid and soda unite to form acetate of soda. The preparation, therefore, is really a mixture of lead plaster and acetate of soda, with the oil and wax, which convert it into a cerate. It is a handsome preparation, and serves for a protective dressing in all cases, in which a gently sedative impression from the preparation of lead may be at the same time indicated.

SIMPLE CERATE (*Ceratum Simplex*, U.S.; *Ceratum*, Lond.) is made by melting together two parts of lard and one of white wax. This is the preparation most commonly used for dressing blisters, excoriations, wounds, and ulcers, when the pure protective influence is required. Peculiar care should be taken to prepare it from perfectly sound materials, and afterwards to keep it sweet.

SIMPLE OINTMENT (*Unguentum Simplex*, U. S., Ed.) differs from the preceding preparation only in the proportion of its ingredients: four parts of lard being employed to one of wax, instead of two parts, as in simple cerate. The proportions in the cerate are adapted to the purposes of a firm covering for ulcers, &c., in which the unctuous matter will retain its place, and not, by melting with the heat of the body, sink into the dressings. The ointment is much softer, and, though it may be used for the same purposes, especially in cold weather, is more frequently employed as a vehicle for other medicines, to be applied by inunction, or spread on linen or patent lint.

II. PLASTERS.

EMPLASTRA.

Plasters are in themselves essentially protective; and, though very often purposely medicated in such a way as to irritate or inflame, or with a view to a general impression on the system through absorption, they nevertheless exclude the influence of the air, and thus far act antiphlogistically upon underlying inflammations. Some of them probably operate usefully in the latter method without having been intended to do so. Thus, the plasters made with *ammoniac* (i. 616), *galbanum* (i. 615), *Burgundy pitch* (ii. 748), and *Canada pitch* (ii. 749), which are employed as revulsives in chronic rheumatism in the loins and elsewhere, chronic swellings of the joints, and various subcutaneous inflammatory tumefactions, and which certainly often produce very happy effects in those complaints, probably operate as much by excluding oxygen from the subcutaneous tissues, as by a revulsive influence. In this way, too, we can understand the useful effects of the *iron plaster*, or *strengthening plaster* (i. 450), which, applied to the small of the back, and the larger joints, has seemed to impart strength; whereas, it has simply removed rheumatic or other inflammatory conditions, partly at least through the method here suggested. So also with the *mercurial plaster* (iii. 285), which, while it is slightly affecting the system, is operating favourably on the protective principle. All the above preparations have been noticed under the proper heads. There are a few which, from their peculiar applicability to protective purposes, deserve to be more particularly noticed here.

1. LEAD PLASTER.—EMPLASTRUM PLUMBI. *U. S., Lond.*—EMPLASTRUM LITHARGYRI. *Ed., Dub.*—Litharge Plaster.—*Diachylon.*

This has been already sufficiently described (i. 172). It is here noticed only to call attention to its peculiar usefulness, not only in relieving excoriation and other superficial inflammation, which it does partly by the sedative influence of the lead, but also as a protection against these conditions. To prevent bed-sores, or injury to the skin from other modes of pressure and friction, as from the pad of a truss, and various surgical dressings, this answers often an excellent purpose; the only objection being its want of sufficient tenacity. This deficiency is supplied in the following preparation.

2. RESIN PLASTER.—EMPLASTRUM RESINÆ. *U.S., Lond., Dub.*—EMPLASTRUM RESINOSUM. *Ed.*—*Emplastrum Adhæsivum.*—*Adhesive Plaster.*

This consists of the above plaster with the addition of a little resin, which gives it adhesiveness. It is very much used in the dressing of wounds and ulcers, in the former to keep their edges together, in the latter to approximate and give support to the granulations. But, while answering these purposes, it probably aids the cure, especially in the ulcers, by excluding the air. There is, on the whole, no plan of treating ulcers in the legs more effectively than by the adhesive plaster and bandaging.

3. SOAP PLASTER.—EMPLASTRUM SAPONIS. *U. S., Lond., Ed., Dub.*

This is the lead plaster incorporated with a little soap. It has long been employed as a discutient application to tumours and swollen joints. If the principles above inculcated are founded in truth, we can easily understand how this preparation may act as an antiphlogistic remedy, and thus perhaps be disposed to give greater weight to the testimony of those who have found it a very useful remedy.

III. COLLODION.

COLLODIUM. *U.S.*

This name has been given to a solution of gun cotton in ether, which was brought to the notice of the profession, in the year 1847, by Dr. J. P. Maynard, then a student of medicine in Boston. For the mode of preparing it, see the U. S. Dispensatory (10th ed., p. 849).

Properties. Collodion is a colourless, transparent liquid, of the consistence of thin syrup. On exposure to the air, the ether rapidly evaporates, and the solution thickens so as to be unfit for use. Hence, it must be kept in well-stopped bottles, and in very small ones, in order to obviate the necessity of frequently opening them. When the solution is spread out uniformly, by means of a brush, there is soon formed, in consequence of the evaporation of the ether, a thin, transparent, very tenacious pellicle, which adheres firmly to the surface with which it is in contact. This is impermeable by air, and insoluble in water, so as to protect the surface completely against those agents. But, in the process of solidification, the preparation undergoes considerable contraction, and acquires a certain degree of inelastic rigidity, which causes it, when applied to a yielding substance like the skin, to produce shrinking or condensation. This last property, though useful for certain purposes in surgery, is very inconvenient for others; and for the latter should be corrected if possible.

Several different additions have been proposed, with various degrees of success, to obviate this inconvenience. An account of them may be seen in the article by Dr. Bache in the U. S. Dispensatory, above referred to. Since that article was prepared, the addition of glycerin has been proposed by MM. Cap and Garot, who speak with great confidence of its utility. Two parts of glycerin added to 100 of collodion, according to these writers, entirely obviate the disadvantages alluded to, giving to the pellicle formed a pliability and elasticity which prevent injurious contraction, and permit free movement of the parts that may be covered.

Uses. In consequence of the adhesiveness and firmness of the pellicle formed by collodion, and of its impermeability by water and air, it answers an excellent purpose for retaining the surfaces of incised wounds in contact, as a dressing for ulcers in which contraction, and the exclusion of atmospheric air are indicated, and as a covering for superficial abrasions, slight injuries, excoriated nipples, intertrigo, &c. Inflammation is obviated, and the parts in general heal kindly under its protection, with which washing with water does not interfere. Another surgical purpose to which it has been applied is to obviate the erections attendant on gonorrhœa; the whole organ being enveloped in a coating, which renders expansion impossible. (See *Am. Journ. Med. Sci.*, N.S., xxvi. 518.) It has been used in other cases, to prevent motion, and thus answer the purposes of splints. A casing for inflamed joints might sometimes

prove useful in this way, and possibly also on the protective principle; but the method should be avoided in severe and acute cases.

Collodion has also been considerably used for the cure of superficial inflammation. Thus, it has been highly recommended in *erysipelas*, and *various cutaneous eruptions*, in which it is supposed to operate partly by emptying the blood-vessels through compression. I believe that the benefit accrues much more from the complete exclusion of the air; and, indeed, the compression has sometimes provoked an increase of the disease by the irritation of the surrounding skin. Dr. Christen, assistant physician to the hospital at Prague, derived no permanent advantage from it in erysipelatous inflammation associated with fever; but found it of decided advantage in that affection when of purely local origin, proceeding from wounds, &c. The same writer tried it in the early stage of *small-pox*, with the view of checking the progress of the eruption in the face; but, though used under the most favourable circumstances, it failed to produce the desired effect. (*Ibid.*, xxv. 418.) It has been employed also in *chilblains*, and is supposed, applied thickly over the surface, to have aided in the *discussion of buboes.* The compression it produces renders it sometimes efficient in the *suppression of hemorrhage*, and it has been recommended for this purpose in leech-bites. It may be used, moreover, to give a lining to *carious excavations in teeth*, in order to protect them from the air.

It is most conveniently applied by a brush. The modified solution, above described, should be preferred in the treatment of inflammatory affections of the skin.

CAOUTCHOUC and **GUTTA PERCHA** have properties similar to those of collodion, and may be used for the same purposes. By taking advantage of their solubility in chloroform, solutions of them may be made, which, when applied in thin layers, very quickly leave pellicles on the surface, having the impermeability of that of collodion, without the same rigidity. Such solutions have been considerably used in cutaneous affections. That of gutta percha is generally preferred. It may be used in all kinds of chronic cutaneous eruptions, especially in the scaly affections, and the advanced stages of eczema. It will often also prove useful in the acute eruptions, though less applicable to cases in which there is watery or puruloid secretion. In *erysipelas* it is said to have been used advantageously, and has the great advantage over collodion, that it does not equally irritate by compression. Success, too, is claimed for it in rendering

the eruption in small pox abortive. In fact, it may be used in all cases of superficial inflammation and slight injuries, in the treatment of which the protective principle is applicable. Dr. Graves, of Dublin, bears special testimony in its favour as a remedy in cutaneous diseases. (*Dub. Quart. Journ. of Med. Sci.*, June, 1852.) An investing layer of this kind might even be tried about the knees and larger joints, affected with obstinate rheumatism, or other chronic inflammation. A closely fitting and adhering coat of caoutchouc is thought to have proved useful in such cases.

The solution in chloroform should be saturated, and the application made by means of a camel's-hair pencil, which, on each occasion, should be immersed in boiling water, to prevent its becoming clogged by the solidified material. The application should be repeated as often as may be necessary to keep the covering complete. In the scaly and scabby affections, the skin should be first cleared, if possible, by poulticing, &c.

2. *Indirect Protectives.*

These operate, in the sound state of the skin, by so altering the epidermis as probably to render it impermeable to the air, and thus to prevent the influence of oxygen on the parts beneath. Applied to the mucous membranes, they enter into combination with the superficial portion of the epithelium, or its whole thickness, forming a similar protecting layer. In ulcers they combine with the albumen of the secretions, and with the superficial tissue, and in this way form an insoluble covering for the surface. These effects are produced by several of the escharotics; and in this way, as well as by an alterative influence, or the removal of the diseased structure, their efficacy in promoting the healing of ulcers may be explained.

1. NITRATE OF SILVER.—ARGENTI NITRAS.

This, I believe, operates as an antiphlogistic remedy most efficiently through the protection it thus affords to the subjacent tissue. The cuticle, blackened under its operation, loses the peculiar organization, in consequence of which liquids and air can find entrance and exit, and probably becomes a much less permeable tissue. Hence the efficiency of this escharotic in erysipelatous and erythematous inflammation, and in numerous cutaneous eruptions. The white layer which it forms with the mucous tissue may operate on the same principle; as may the insoluble white pellicle which it leaves after it upon ulcerated and abraded surfaces. But, under the head

of escharotics, the effects of nitrate of silver have been sufficiently detailed; and I allude to them here only as belonging to the present category of influences, and illustrative of the principles stated.

2. IODINE. — IODINIUM.

This is another agent which has proved very efficacious in numerous superficial disorders, of a nature to be benefited through the protective agency. The *tincture of iodine* is the preparation usually employed for the purpose, and, in the greater number of cases, will answer very well. When, however, a very strong impression is demanded, the tincture may be saturated, which is easily done by leaving in the bottle a little more iodine than is dissolved. The strength may be made still greater by using iodide of potassium, which increases the solvent power of alcohol as it does of water. Thus, by adding half a drachm of the iodide of potassium to a fluidounce of alcohol, it may be made to dissolve a drachm of iodine. A solution of this kind has been used by Dr. Todd, of London. Some prefer an *ethereal solution*, of the same strength as the officinal tincture, under the idea that it is less painful; and, as the ether rapidly evaporates, while the alcohol remains for some time to stimulate the surface, there seems to be good reason for the preference. (Durkee, *Am. Journ. of Med. Sci.*, N. S., xxviii. 108.)

When one of these preparations is applied by a brush to the surface of the skin, it rapidly produces a yellow discoloration of the epidermis, with more or less smarting pain, of which the patient sometimes complains a good deal, but which soon subsides. If the application has been moderate, the stain gradually disappears, by the evaporation of the iodine, without any organic change in the cuticle. But such an influence is of little or no effect for the purposes here had in view. The application must be made so as to produce a deep-brown stain of the cuticle, which should be so much affected, as afterwards to desquamate. It is often necessary, moreover, to reapply the tincture, and to do so repeatedly, should the evidence of its action on the epidermis diminish. I have often noticed, in erysipelas, while using mucilaginous dressings of slippery elm to the surface, and tincture of iodine to the border of the inflammation, that the stains produced by the latter rapidly disappear under contact with the former; and the inference is that such a contact should be guarded against, in the use of the remedy.

Erysipelas is one of the affections in which iodine has shown the greatest antiphlogistic power. Applied over the whole surface, it will not unfrequently diminish or even subdue the inflammation.

But it must be remembered that erysipelas is usually a constitutional affection, and that, if the inflammation is suppressed, the disease is not cured; and there may be danger of the local irritation fixing itself elsewhere, perhaps in some internal organ. It has happened to me to witness a fatal case of such translation, and, though the local application made in that instance was not iodine, yet the principle would be the same with either, and I have, therefore, always avoided any efforts at once to cure the local affection. But when disposed to spread into the head, or too extensively elsewhere, I have very long been in the habit of endeavouring to circumscribe its progress, and keep it within due bounds. For this purpose, iodine is, I think, on the whole the most convenient and effectual means. It should be applied for two or three inches in breadth, partly on the inflamed and partly on the sound surface. When it fails to check the march of the inflammation, it usually moderates its severity. In local erysipelas, arising from wounds, with or without the suspicion of poison, as in dissecting wounds, I have also been in the habit of using tincture of iodine, and, I think, with advantage.

In *herpes*, and *eczema*, it will sometimes arrest the disease in its early stages; but in the latter affection it will often fail, because the local disease is sustained by a powerful constitutional tendency; and, in many cases, no suppressing agents, however powerful, are capable of subduing it. *Herpetic ringworms* will frequently yield at once.

The tincture of iodine is also among the most effective means of checking the progress of the *variolous eruption*. Applied, at the first appearance of the eruption, or within a day or two, it will often very considerably modify it, and prevent full maturation and pitting.

But iodine acts also on deeper inflammations. Thus, it may be employed with advantage in *inflammation of the absorbents and cellular tissue* of the arm or leg, such as occasionally follow wounds of the fingers or toes. It must be liberally applied upon the skin, along the course of the inflamed vessels.

In inflammation of the *absorbent glands*, it may be similarly employed.

It has also been highly recommended in *chronic enlargements of the tonsils*, applied directly to the mucous membrane covering them.

It is highly useful in *inflamed and distended bursæ*, such as are

frequently noticed in rheumatic patients, and, applied freely around the joints, has been found serviceable in similar affections of the *synovial membranes*. Indeed, the tincture of iodine, locally applied, may be used with hope of benefit in most cases of *chronic inflammation and tumefaction of the joints*, whether rheumatic, gouty, or scrofulous.

Furuncles, *phlegmons* in the subcutaneous tissue, and *paronychiæ* may be treated in the same way.

3. CREASOTE. — CREASOTUM.

This is another of the remedies that operate indirectly on the protective principle. Though a powerful irritant itself, it often proves useful in ulcerative affections. When applied undiluted to a surface of this kind, it coagulates the albumen, and thus gives a white coating, which protects the parts beneath. It should be used only in the *indolent* and *flabby ulcers*, the *phagedenic*, or the *gangrenous ulcers* following burns; and never in those already in a highly inflamed state.

On a former occasion, I spoke of the efficacy of creasote in toothache, and ascribed it in part to the insoluble coating it gives to the carious surface.

Division II.

NON-SYSTEMIC REMEDIES.

THESE are remedies acting, not essentially and directly on the functions or organs, but on some extraneous body or bodies incidentally present in the system, and operating injuriously upon it. The division includes only the two classes of antacids and anthelmintics. I might have made a third, embracing medicines which correct the effects of acrid matters in the alimentary canal by an absorbent property; but, as the single medicine which would represent the class has the property of absorbing acids also, I have thought it most expedient to include it in the class of antacids.

It may be objected to the classification here adopted, that the two great divisions are so extremely—one might almost say, so absurdly different in their dimensions. My only answer is, that this is the method of nature; and if I have erred, I have done so in following her footsteps. If the inquirer will look beyond the science which engages our attention, out into the broader fields of nature, he will observe similar inequalities constantly repeated, both in the physical and the moral world; and will learn in time that, though they may seem discordant when viewed partially, yet the general effect is that of order and beauty. Could our finite capacity embrace the whole, we should undoubtedly find unbroken harmony.

CLASS I.

ANTACIDS.

THESE are medicines which correct acidity in whatever part of the body they may encounter it, either by neutralizing or physically absorbing the acid. It must be recollected, however, that, in some parts of the system, the presence of a certain proportion of

free acid is normal, and even essential to health. Thus, during the period of digestion, it is now universally admitted that the gastric juice is normally sour, and that this condition is greatly promotive of its solvent power; and a certain degree of acidity of the urine is required, in order that the phosphatic salts may at all times be held in solution. It is, therefore, only an excess of acid beyond the wants of the function that requires correction. Such an excess frequently exists in the stomach and bowels. Though it is probably impossible that the blood should become positively acid during life, yet acid substances not unfrequently are either generated in it or find their way into it, and are rejected through the different emunctories, as the skin, lungs, and kidneys; and a sour breath, and sour odour of the perspiration, would evince such a state of system. Again, a considerable excess of acid is often met with in the urine, irritating the lining membrane of the urinary passages, and sometimes leading to the deposition of uric acid. This is not the place to treat of the causes of this excess, of its symptoms, or its effects. These are subjects for the pathologist. Our business here is to point out the methods of correcting it; at least to indicate those measures by which the effects of acid, abnormally existing in the system, may be obviated, independently of any agency upon the functions.

1. *Modes of Operation.*

1. The most efficient method of accomplishing this object is by means of medicines which are capable of uniting with and neutralizing the acids; of converting these irritating substances into mild and innoxious neutral salts. Now any salifiable base will accomplish this object, so far as the acids in the alimentary canal are concerned; but it does not follow that they could all be used for this purpose with impunity. The oxides of silver, copper, antimony, &c., are capable of neutralizing acids, but in doing so they are converted into powerfully irritating, and even poisonous salts. It is only, therefore, those salifiable bases which form innoxious compounds with the acids they neutralize, that can be used. Of this kind are the medicinal alkalies and alkaline earths, and their carbonates, with the exception of baryta, which cannot be safely used for the purpose; and these are the substances employed as direct antacids.

But it is proper to make some discrimination between these antacids. Some are insoluble, or very nearly so, and consequently

cannot enter the circulation until they have become neutralized. It is clear that these may be used for correcting acid in the primæ viæ, but not in the blood, or the secretions. They may, indeed, indirectly correct acid in these latter situations, by preventing its entrance into the circulation from the alimentary canal; but they cannot act upon that which may exist in the blood already, or may be generated in that fluid, or conveyed into it by the lymphatics from the disintegrating tissues. For this purpose the soluble antacids must be used, which, if in excess, after the neutralization of the acid in the stomach, may then enter the blood. These, after having restored the requisite degree of alkalinity to the blood, become themselves noxious, and are thrown off by the emunctories, and thus neutralize or alkalize the secretions. Sour breath and sour perspiration may thus be corrected, and the acidity of urine replaced by alkalinity of that liquid. Magnesia and its carbonate, and the carbonate of lime are in the former category, the alkalies and their carbonates, and lime-water in the latter.

2. The second method in which antacids operate is by simply absorbing the acid without chemically combining with it, and thus preventing it from injurious action upon the tissues. The only agent with which I am acquainted, certainly capable of producing this effect, is charcoal, which I, therefore, rank among the antacids, though it has no neutralizing effect.

2. *Therapeutic Application.*

In *poisoning by the acids*, as the sulphuric, nitric, muriatic, oxalic, and even tartaric in great excess, this class of remedies are the appropriate antidotes, and should always be promptly employed, along with free dilution, and evacuants.

Dyspepsia often offers strong indications for the use of antacids, to correct the cardialgia, gastric spasms, and other uneasiness so frequently attendant on that disorder. But it must be remembered that these medicines are here only palliatives; and that, in excess, they may do harm, partly by depriving the gastric juice of its normal proportion of acid, and partly by directly irritating the stomach. Their use, therefore, requires judgment, and they should not be given indiscriminately in dyspepsia, whenever any little uneasiness may seem, in the mind of the patient, to require them.

In *infantile colics*, and other digestive disorders, acid is a very frequent cause of the suffering, and the antacids are often of great service, sometimes even relieving serious diseases, which appear to

have their origin in irritation of the primæ viæ from this cause. In the *colicky affection of adults* they will also often be found to afford relief.

Diarrhœa is not unfrequently, both in adults and children, and especially in the latter, either produced or sustained by acid in the bowels, as indicated by the sour smelling and green passages, and not unfrequently also sour breath and eructations. Hence antacids are among our habitual remedies in this affection.

Sick-headache often depends on an excess of acid in the stomach, and may not unfrequently be anticipated or cured by a full dose of magnesia, or other medicine belonging to the class.

Febrile diseases, in their course, often evince, by the sour smell of the breath and the perspiration, the existence of acid in the blood, and call for the use of this class of medicines. This is especially apt to be the case in the fevers of children. It is obvious that the antacids should here be selected, which are capable of being absorbed into the blood, as the alkaline carbonate or bicarbonates.

Gout and rheumatism frequently afford the same indication; and the alkaline method of treating these diseases has strong advocates among those who believe that acid is the essential materies morbi in these diseases.

In *diabetes* there is often a sourish as well as saccharine smell issuing from the patient, which proves the abnormal elaboration of acid in the system, calling for antacids; and, so far as medicines can affect the course of this fearful disease, the alkalies are among those most to be relied on.

The *uric acid lithiasis* offers another indication for antacids; and there are no means so efficacious in affording relief, in the gravelly and other urinary disorders dependent on an excess of uric acid or the urates in the urine. The soluble alkaline carbonates are, of course, here also specially indicated.

From the remarks which have been made, it is obvious that a considerable discrimination is necessary in the choice of the antacid, to adapt it to the circumstances of each case. Thus, in the bowel affections, magnesia and lime, or their carbonate, are usually preferable, the magnesian preparations being used when there is indication at the same time for a laxative effect, the calcareous, when it is desirable to produce rather an astringent effect on the bowels than otherwise. When the blood and urine are to be reached, the choice should fall on the alkalies or their carbonates; and here, as a general rule, the carbonates are to be preferred to the caustic alkalies,

and the bicarbonates to the carbonates, as being milder in their operation on the mucous membrane of the primæ viæ.

Incidental to their operation as antacids, these remedies often act as laxatives, refrigerants, diuretics, or diaphoretics, by means of the saline compounds which they form with the acids, and which may act on the bowels, or be absorbed. They are sometimes very useful in this way.

But it must be remembered, in using the alkaline antacids for these various purposes, that all that is required is the neutralization of an abnormal excess of acids, and that it is desirable not to substitute an excess of alkalinity, unless some special indication for this condition exist.

3. *Effects and Uses of Alkalies as Dynamic Agents.*

1. *Effects.* Hitherto I have been treating of alkaline substances merely as antacids. When themselves in excess, they become real dynamic agents, producing important modifications in the condition of the system. Strictly speaking, this subject should have been considered in the first division of remedies; and the proper place of the alkalies would, in this view, have been found among the arterial sedatives; but precision of classification may sometimes give way to expediency; and I have thought it would be both more convenient and more impressive to consider the alkalies, under these two different aspects of purely chemical and of dynamic agency, in the same place; especially as these two modes of operation are constantly running one into the other in practice.

When in excess in the stomach and bowels, the alkalies act as irritants, and, very largely given, or in a concentrated state, may cause severe inflammation, and even corrosion. Their abuse is apt to induce want of appetite, gastric uneasiness, and other symptoms of dyspepsia.

A certain excess of alkali in the blood is essential to the continued solubility of the albumen and fibrin, and possibly for other purposes; but, beyond the normal amount, it produces depressing effects, dependent probably on a direct alteration in the condition of the organized constituents of that fluid. The coagulability of the fibrin is probably impaired, and, under a very powerful influence, the blood-corpuscles themselves, to a certain extent, broken up and dissolved.

In the urine, a similar excess disposes to the deposition of the

phosphate of lime, and the ammonio-magnesian phosphate, which require the presence of acid in the urine to hold them in solution. A tendency to calculous formations of this character may thus be promoted.

2. *Therapeutic Application.* But, while excessive alkalinity in the system is thus in various ways injurious, a certain amount of it may be advantageously applied to therapeutic purposes. From the influence exerted on the blood, that fluid becomes less capable of duly supporting the vital processes, and a general depression is produced. Hence the alkalies may sometimes be advantageously employed in *inflammatory* and *plethoric* affections. They are supposed to be peculiarly efficacious in *pseudomembranous inflammation*, as they diminish the coagulability of fibrin, and therefore lessen the tendency to its exudation in the plastic state. On this account they have been used largely, and with supposed advantage, in *pseudomembranous croup*, and might be employed, with hope of benefit, in similar affections of the bronchial tubes and alimentary mucous membrane, forming varieties of *bronchitis*, *enteritis*, and *dysentery*. It is probable that they operate advantageously in *acute rheumatism*, much more on this antiphlogistic principle than by the mere neutralization of acid.

Cutaneous eruptions are among the affections in which the alkalies are most frequently used; being taken internally, and not unfrequently applied externally at the same time. Internally, they act in part by neutralizing acid in the primæ viæ and the circulation, which has great influence in sustaining the eruptive affection, and in part probably as antiphlogistic remedies through their influence on the blood. Externally, they act mainly as local excitants; and may be employed among the earliest of this class of applications, as the disease is passing from the acute to the chronic stage.

In *urinary affections*, the alkalies also act advantageously. As mere antacids, they have already been considered. But they are thought to be capable of doing something more than merely to neutralize the acid in the urine. It is believed that, by maintaining a constant alkalinity in the urine, uric acid or the urates deposited in the shape of sand or gravel in the uriniferous tubules, the calyces, or the pelvis of the kidney, may be dissolved; and the same possibility may even be considered as extending to stone in the bladder, composed of the same material. In the latter case, it has been proposed to effect a solution of the stone in the bladder by injecting solutions of the alkaline carbonates, or bicarbonates; but, though a rational

proceeding, it has not hitherto been able to boast of much success, possibly from the want of sufficient perseverance.

The alkalies have been thought to possess a deobstruent power over chronic glandular and visceral enlargements; but their influence, in these affections, resolves itself into a simple antiphlogistic operation, through the changed state of the blood already referred to.

When alkalinity of the blood or urine is aimed at, it is on the whole best to use the bicarbonates, as less irritant to the stomach and bowels, than the more caustic preparation; and the neutral alkaline salts of the vegetable acids might perhaps frequently be substituted, as their acid undergoes decomposition, and the base enters the circulation in part as a carbonate.

I. POTASSA AND ITS CARBONATES.

I. SOLUTION OF POTASSA.—LIQUOR POTASSÆ. *U. S., Lond.*—POTASSÆ AQUA. *Ed.*—POTASSÆ CAUSTICÆ LIQUOR. *Dub.*—*Water of Potassa.*

Preparation and Properties. The officinal solution of potassa is prepared by boiling caustic lime with a solution of carbonate of potassa. The lime takes the carbonic acid, and falls as an insoluble carbonate, and the liberated potassa remains dissolved in the water, which is decanted, when it has become clear after standing. The materials are used in definite quantities, and the resulting solution has consequently a definite strength. Prepared according to the directions of the U.S. Pharmacopœia, it has the sp. gr. 1.056. As the London preparation, which has the sp. gr. 1.063, contains 6.7 per cent. of pure potassa, ours must have considerably less; and the solution cannot, therefore, be said to be strong.

It is perfectly colourless and inodorous, and has very strongly the peculiar acrid, very disagreeable, soapy taste of the alkalies. It is known to contain potassa by affording a yellow precipitate with chloride of platinum, and a copious white precipitate of bitartrate of potassa with an excess of tartaric acid. It is *incompatible* with all the acids, the acidulous salts, the soluble salts of the common metals, including their soluble chlorides and iodides, the salts of ammonia, and calomel. It dissolves resins and fixed oils, forming soaps with the latter. As it attracts carbonic acid from the air, it should be kept in well-stopped bottles.

Medical Effects and Uses. Solution of potassa has, in a high de-

gree, all the characteristic properties of the alkalies. In relation, however, to the neutralizing or antacid power, both this preparation and the carbonates are much inferior, for equal weights of the pure alkali or earth, to any other of the medicines used as antacids; for, while the equivalent of soda, which is next in order, is 31.3, that of potassa is 47.2; that is, the quantity of acid which will require 31.3 parts of the former for neutralization, will require 47.2 of the latter. Hence, purely as antacids, potassa and its carbonates stand at the bottom of the scale.

In over-doses, the solution of potassa is capable of producing fatal inflammation or erosion of the stomach. In a case of poisoning, the proper antidote would be one of the vegetable acids, as vinegar, lemon-juice, or tartaric acid; and, if neither of these should be at hand, one of the mineral acids, much diluted.

The solution has been used for the antacid, antilithic, and antiphlogistic effects of the alkalies, but has no advantage whatever over the carbonates, while it is more unpleasant, and much more hazardous. It should, therefore, I think, be abandoned as an internal remedy. Externally, it is sometimes used as a rubefacient, but has no special virtues in this capacity. It is more important as a pharmaceutic than as a therapeutic agent. The dose for internal use is from ten to thirty minims, twice or three times a day. When given, it should be largely diluted either with water, one of the aromatic waters, or a bitter infusion.

II. CARBONATE OF POTASSA. — POTASSÆ CARBONAS. *U. S., Lond., Ed. — Salt of Tartar.*

Preparation. As the carbonate of potassa is kept in the shops, it is usually prepared from *pearlash*, which is an impure carbonate, obtained from the common potash of commerce, by exposing it to the flame of a reverberatory furnace. The process for purifying pearlash consists simply in dissolving it in a very small proportion of water, filtering and evaporating the solution, and granulating by constant stirring, when the liquid solidifies on being allowed to cool. The carbonate of potassa is thus separated from the less soluble salts, and the insoluble substances contained in pearlash. It is still, however, impure; containing chloride of potassium, a little silicate of potassa, and other saline matters derived originally from the wood-ashes, from which the crude potash was obtained. These impurities, however, do not materially impair its medicinal efficiency.

A purer salt is made by exposing the *bicarbonate of potassa* to a red heat, by which one equivalent of carbonic acid is driven off, and

the carbonate remains. This is directed by the U. S. Pharmacopœia under the name of *Pure Carbonate of Potassa* or *Potassæ Carbonas Purus.* The salt was formerly procured by calcining the bitartrate of potassa, which is thus converted into the carbonate; and as the bitartrate was only a pure form of *tartar*, the name given to the matter deposited by wine, the carbonate received the name of *salt of tartar*, which it retains to this day from whatever source procured.

Properties. Carbonate of potassa is usually in the form of a white granular powder, inodorous, and of an unpleasant, acrid, alkaline taste. It is extremely soluble in water, but insoluble in alcohol. On exposure to the air, it rapidly attracts moisture, deliquesces, and is converted at length into a dense oil-like liquid, which, though nothing but a concentrated solution of the salt, received of old the name of *oleum tartari per deliquium.* From this tendency to deliquesce, it is necessary to be careful not to expose the salt to the air; and to diminish the rapidity of the change is one of the objects in granulating it. Carbonate of potassa, though neutral in composition, that is, consisting of one equivalent of acid and one of base, has a strong alkaline taste, and an alkaline reaction on colouring matters. It is incompatible with acids and acidulous salts, with acetate of ammonia, with lime-water and the soluble salts of lime, with the soluble salts of magnesia, iron, copper, mercury, silver, lead, zinc, and antimony, and with alum and calomel. It does not, however, decompose the tartrate of iron and potassa, from the peculiar mode in which the iron exists in that salt. When heated to redness it becomes anhydrous, but, as ordinarily used, contains, according to Mr. Phillips, 3 eqs. of water for 2 eqs. of the salt.

Medical Effects and Uses. This salt exercises all the peculiar influence of the alkalies on the system, and is among the preparations most used, for the various purposes for which these medicines are given. Though less irritant and poisonous than the solution of potassa, it is yet capable, in large quantities, of inflaming and even cauterizing the stomach, and causing speedy death. Should the patient survive the first shock of the poison, he sometimes dies, after several weeks, in consequence of the disorganized condition of the digestive organs. Instances, too, have been related in which death occurred long after the taking of the salt, in consequence of stricture of the œsophagus, supposed to have originated from injury done to that structure. The antidotes are the same as for

poisoning with potassa. Sulphate of magnesia might be used for the purpose.

It is unnecessary to mention here the various diseases in which carbonate of potassa is given as an alkali. They have already been stated in the general observations. Though occasionally used to correct acid in the stomach, and as an antilithic in the uric acid deposition, it is less esteemed, merely as an antacid, than some other articles of the class; but it seems to be generally preferred, when the object is to alkalize the system. Hence it is used in *pseudo-membranous croup* and other pseudomembranous diseases, and is a favourite remedy in *cutaneous eruptions*, in which it certainly seems occasionally to produce very favourable effects. It has also been recommended in *pneumonia* and other inflammatory affections. Associated with cochineal, it has long been a popular remedy in *hooping-cough*. In *jaundice* it appears sometimes to act beneficially in restoring the secretion of bile, and has long been used in that disease. In *biliary calculi* it may also be given in the hope of rendering the bile, by its increased alkalinity, capable of dissolving this deposition. Under the diuretics, I spoke of it as having diuretic properties, and as being sometimes advantageously employed as an adjuvant with other remedies in *dropsy*. It might also be tried in *scurvy*, in order to supply the deficiency of the salts of potassa, which Dr. Garrod has shown to exist in that disease.

The dose is from ten to thirty grains, twice or three times a day, dissolved in a wineglassful or more of water, which may be sweetened, and aromatized by any agreeable aromatic oil.

Externally it is employed as a lotion in cutaneous eruptions, dissolved in the proportion of from one to three drachms to the pint of water. It is advisable to begin with the smaller proportion, and increase to the higher, as the skin is found to bear it. Alkaline baths, for use in similar cases, may be prepared by adding from half a pound to a pound of the carbonate to the whole quantity of water used, to be increased if found desirable. The salt is also sometimes applied to the skin, in the form of an ointment, made by rubbing up from ten grains to a drachm with an ounce of lard.

There is an officinal *Solution of Carbonate of Potassa* (LIQUOR POTASSÆ CARBONATIS, *U. S.*, *Lond.*, *Dub.*) consisting of a pound of the carbonate dissolved in twelve fluidounces of water. It is merely a convenient form for administering the salt. The dose is from fifteen minims to a fluidrachm.

III. BICARBONATE OF POTASSA.—POTASSÆ BICARBONAS. *U. S., Lond., Ed., Dub.*

Preparation. This is prepared by passing carbonic acid through a solution of carbonate of potassa until it ceases to be absorbed, then filtering, and evaporating at a temperature not exceeding 160°, so that crystallization may take place. In the process, the carbonate of potassa simply combines with an additional equivalent of carbonic acid. If a higher heat were employed in the evaporation, there would be risk of the escape of a portion of the carbonic acid of the newly formed salt. In the act of crystallization, the impurities contained in the carbonate are left behind. Much of this salt is prepared by brewers, by exposing a saturated solution of the carbonate of potassa to the atmosphere of carbonic acid in their vats. As the salt becomes bicarbonated, it is deposited in crystals, being much less soluble than the carbonate. Thus prepared, it is called *sal æratus*, and is much used for making light bread, cakes, &c., as a substitute for fermentation.

Properties. Bicarbonate of potassa is in colourless transparent crystals, which are irregular eight-sided pyramids with two-sided summits, inodorous, and of a saline somewhat alkaline taste. The salt is soluble in four times its weight of cold water, and less than its weight of boiling water, which deprives it of a portion of carbonic acid and converts it into a sesquicarbonate. At a red heat, it loses one equivalent of acid, and all its water of crystallization, and becomes anhydrous carbonate. It is permanent in the air.

Medical Uses. The effects of this salt are similar to those of the carbonate, but feebler. As an antacid, it operates precisely in the same way, only that a larger dose is required. In this capacity, therefore, it is preferable to the carbonate, as it is less unpleasant to the taste, and less apt to irritate the stomach. Merely for correcting acid in the stomach or circulation, or as a remedy in the uric acid lithiasis, it may with advantage be substituted for that salt. But I doubt its equal efficiency in alkalizing the system. The additional equivalent of carbonic acid probably qualifies, in some degree, its operation on the organized constituents of the blood. When, therefore, it is desired to obtain the antiphlogistic action of the alkali, the carbonate should be preferred. The dose is from twenty grains to a drachm.

Both this and the carbonate are much used in the preparation of the neutral mixture and effervescing draught.

II. PREPARATIONS OF SODA.

I. CARBONATE OF SODA. — SODÆ CARBONAS. *U. S., Lond., Ed.*— SODÆ CARBONAS CRYSTALLIZATUM. *Dub.*

This is now always made, on a large scale, by the manufacturer. Formerly it was prepared from the ashes of sea-weeds, usually called *kelp*, or from that of plants growing by the seaside and cultivated for the purpose, which is known in commerce by the name of *barilla*. At present it is procured almost exclusively by the decomposition of sulphate of soda. This salt, having been prepared by acting on common salt with dilute sulphuric acid, is exposed to heat in a reverberatory furnace with carbonate of lime and bituminous coal, which react upon it so as to produce a mixture, consisting of carbonate of soda, caustic soda, sulphuret of calcium, undecomposed sulphate of soda, &c. From this the soluble substances are separated by lixiviation, and, having been procured in the solid state, are again exposed to heat with carbonaceous matter, as coal-dust, sawdust, &c. The caustic soda is thus carbonated, and the remaining sulphate converted first into sulphuret, and finally into carbonate, which now becomes the chief constituent. In this state the preparation is called *soda ash*. From this the carbonate of soda is obtained by lixiviation and evaporation, and is subsequently purified by solution and crystallization.

Properties. The salt is in fine large transparent rhombic prisms, which speedily effloresce on exposure to the air; and, as found in the shops, they are in various conditions between the two extremes of perfect crystal and an opaque white powder. Exposed to heat, they effloresce more rapidly, and at a red heat give up all their water of crystallization. The salt is inodorous, and has a saline, acrid, and alkaline taste, but less disagreeable than that of the corresponding salt of potassa. It is soluble in twice its weight of cool water, and insoluble in alcohol. It has an alkaline reaction on vegetable colours.

The crystals of carbonate of soda contain one equivalent of carbonic acid, one of soda, and ten of water; and the proportion of water of crystallization is 64 per cent.; so that the perfectly dried salt is nearly three times as strong as the perfectly crystallized.

Medical Effects and Uses. These are so nearly the same as those of carbonate of potassa, that I must content myself with referring to what has been stated of that salt. It is used for the same pur-

poses internally and externally. In consequence of its less disagreeable taste, it is usually preferred to the carbonate of potassa as an antacid; but is less relied on for alkalizing the system. It has been supposed, however, to be specially useful in the resolution of *goitre*. In consequence of its inequality of strength, according to the degree of its efflorescence, it is impossible to give a precise dose of the salt as ordinarily found in the shops. From fifteen grains to a drachm of the crystallized, and five grains to a scruple of the perfectly dried salt, may be given twice or three times a day. For external use, the same preparation and proportions may be used as of carbonate of potassa. (See *page* 850.)

Dried Carbonate of Soda (SODÆ CARBONAS EXSICCATUS, *U. S.;* SODÆ CARBONAS EXSICCATA, *Lond.;* SODÆ CARBONAS SICCATUM, *Dub.*) has been directed in the Pharmacopœias, in consequence of the inequality of the partially effloresced salt. It is prepared by exposing the crystals to heat until entirely deprived of their water. The dose has been stated above. One advantage of the preparation is, that it may be given in pills if thought advisable.

II. BICARBONATE OF SODA.—SODÆ BICARBONAS. *U. S., Lond., Ed., Dub.*

Preparation. Bicarbonate of soda is prepared by exposing the crystals of the carbonate to an atmosphere of carbonic acid, in a close box, under pressure. The carbonic acid is absorbed, and the water of crystallization of the crystals, not being wanted for the new salt, separates and flows off. To admit of its escape, the crystals are placed on a diaphragm in the instrument, pierced with holes. The crystals lose their crystalline appearance in the process, and become opaque, white, and porous. When the absorption is completed they are removed from the apparatus, dried, and pulverized.

Properties. As in the shops, this salt is always in the state of a fine white powder. It is inodorous, and has a saline slightly alkaline taste, which is less disagreeable than that of the corresponding salt of potassa, or indeed of any of the soluble antacids. It is unchanged in the air. At the boiling temperature it gradually gives out carbonic acid, and is converted into the sesquicarbonate. Thirteen parts of cold water are required for its solution. When quite pure, it consists of two equivalents of carbonic acid, one of soda, and one of water, and contains nearly twice as much soda in 100 parts as the crystallized carbonate, in consequence of the abundance of water of crystallization in the latter. Thus, the

percentage of soda in the crystals of the carbonate is 20, in the bicarbonate about 37. The ordinary bicarbonate of commerce is seldom quite free from carbonate, a small portion of the latter having escaped decomposition in the process for preparing it.

Medical Effects and Uses. This is the mildest, least disagreeable, and most largely employed of all the alkaline antacids. To the carbonate of soda it is preferable on account of its more uniform dose and greater mildness, and to the preparations of potassa for its greater neutralizing power, less unpleasant taste, and greater acceptability to the stomach. In all cases calling for the use of an antacid, without any special indication for an astringent or laxative effect on the bowels, this salt may be selected. The carbonates of potassa may have a greater influence on the secretions, and may be more effectual in altering the blood; but for the neutralization of acid in any part of the system, this preparation of soda is to be preferred. In the cases of red sediment in the urine, it often acts like a charm in correcting it, and is above all other remedies useful in the urinary affections, connected either with excess or deposition of uric acid. It has here the advantage over the carbonate that it does not endanger, if in excess, a precipitation of the phosphates; as the excess of carbonic acid is said to hold them in solution. In the acidity of indigestion, in sick-headache from the same cause, in the sour breath and sour cutaneous exhalations of febrile disease, especially in children, this is the best remedy to which we can have recourse. It may be given dissolved in pure water, or in some aromatic water, sweetened if desired; but the most agreeable vehicle is, on the whole, carbonic acid water. It should always be thus administered when there is a conjoint indication for an anti-emetic and antacid; as in an irritable stomach with acidity. It is also preferable in the urinary affections; as it secures that predominance of carbonic acid which favors the solution of the phosphates. A solution of a drachm of bicarbonate of soda, with half a fluidounce or a fluidounce of ginger syrup, in eight fluidounces of carbonic acid water, is an excellent formula for administering the salt in disorders of the urine. One-third of the quantity may be taken morning, noon, and night; the bottle being immediately and carefully closed after each dose, turned up on its cork, and kept in a cold place, surrounded with ice if to be had. The dose of the bicarbonate of soda is from twenty grains to a drachm, twice or three times a day, when repetition is required.

III. PREPARATIONS OF AMMONIA.

I. SOLUTION OF AMMONIA.—LIQUOR AMMONIÆ. *U. S., Lond., Dub.*—AMMONIÆ AQUA. *Ed.*—*Water of Ammonia.*

This is a solution of gaseous ammonia in water. It has already been considered in relation to its preparation, properties, and external use (ii. 755). In its general operation, it is an arterial stimulant, corresponding in its effects with carbonate of ammonia (i. 569). It is not, however, much used internally; the carbonate of ammonia being generally preferred for a stimulant impression on the system, and the aromatic spirit of ammonia as an antacid, and local stimulant to the stomach. Nevertheless, it is occasionally employed; and the reader is referred to the two medicines just mentioned for the special purposes to which it may be applied. It has enjoyed some credit, as an internal and local remedy, in the bites of serpents and other venomous animals; and is thought to correct, in some degree, the effects of alcoholic intoxication.

The dose is from ten to thirty minims, which should be largely diluted when taken; not less than a wineglassful of water being required. A patient of mine once attempted to swallow a small portion undiluted. The interior of the mouth was intensely inflamed, and the tongue to a considerable extent excoriated. In such a case, the patient should immediately wash out his mouth with vinegar, and afterwards apply almond or olive oil. In poisoning by an over-dose of the solution swallowed, vinegar or lemon-juice should be immediately taken as antidotes, the stomach well cleansed, almond oil afterwards administered in emulsion, and suitable measures employed to moderate the inflammation.

II. SPIRIT OF AMMONIA.—SPIRITUS AMMONIÆ. *U. S., Ed.*

This differs from the preceding simply in the circumstance, that alcohol is used as the menstruum instead of water. It is prepared in the same manner, and is intended to be of the same ammoniacal strength. Its only advantage is, that, in consequence of its alcoholic menstruum, it admits of admixture sometimes with substances for external use, with which water might be chemically incompatible, as with the resinous and gummi-resinous tinctures, and alcoholic solutions of camphor, and the volatile oils. With these it is sometimes associated in the preparation of rubefacient liniments, or of mixtures for internal use; which, however, always require to be diluted freely with water at the time of exhibition. The spirit of

ammonia may be used internally, under similar circumstances with the watery solution, the carbonate, or the aromatic spirit of ammonia. The dose of the U. S. spirit, which has the sp. gr. 0.831, is from ten to thirty minims.

III. AROMATIC SPIRIT OF AMMONIA.—SPIRITUS AMMONIÆ AROMATICUS. *U. S., Lond., Ed., Dub.*

According to the directions of the U. S. and London Pharmacopœias, this is prepared by distilling a mixture of muriate of ammonia, carbonate of potassa, cinnamon, cloves, lemon-peel, alcohol, and water. The carbonic acid and ammonia unite to form the monocarbonate of ammonia, which distils over with the alcohol, impregnated with the volatile oils of the aromatics used; while the liberated potassa and muriatic acid react so as to produce chloride of potassium, which remains behind dissolved in the water.

The spirit is, therefore, a solution of carbonate of ammonia in alcohol impregnated with aromatics. It is nearly colourless, of an agreeable aromatic and refreshing, though pungent odour, and of a warm, acrid, alkaline taste, which, however, when the liquid is diluted and sweetened, is very favourably modified; and this is the least disagreeable to the palate of the ammoniacal preparations. The aromatic spirit, though it produces the same effects as the aqueous solution and spirit on the system, is much milder. On these accounts, it is now very generally preferred for internal administration. It is much used in cases of acidity of stomach, with a depressed or weakened state of the organ, and more or less general debility at the same time. A dose of it often checks a tendency to faintness or asphyxia, and sometimes proves serviceable in the sick-headaches of nervous persons. It often also affords speedy relief in flatulent pains of the stomach, gastrodynia, and cardialgia. With other antacids, such as magnesia and the alkaline carbonates, it is often associated in prescription, in order to render them more stimulant to a torpid stomach. It may also be added to the saline cathartics, under similar circumstances, to counteract their depressing effect on the digestive organs. The simple smell of it is often sufficient to rouse a patient out of faintness, and to check various nervous disorders in hysterical women.

The dose is from thirty minims to a fluidrachm, which may be given in a wineglassful of sweetened water. An over-dose of it might produce serious effects. Care should be taken not to confound this with the Edinburgh and Dublin aromatic spirits, which are much stronger, and contain caustic ammonia instead of the carbonate.

IV. CARBONATE OF AMMONIA.—AMMONIÆ CARBONAS. *U. S.*, *Ed.*—AMMONIÆ SESQUICARBONAS. *Lond.*, *Dub.*

Of this I have treated so fully among the arterial stimulants, that it is unnecessary for me to say more, in this place, than that it may be given as a stimulant antacid, under circumstances similar to those which call for the aromatic spirit. The dose of it would be from two or three to ten or fifteen grains; the larger dose being justifiable when there is much acid, from the rapidity with which it is neutralized. This also must be given with a large proportion of water: and its acrimony may be somewhat blunted by the admixture of mucilage of gum arabic, or sugar.

IV. PREPARATIONS OF LIME.

I. LIME-WATER.—LIQUOR CALCIS. *U. S.*, *Lond.*, *Dub.*—AQUA CALCIS. *Ed.*

Preparation and Properties. Lime-water is prepared by first slaking lime with a little water, then pouring upon it, in a large bottle, a convenient quantity of water, and shaking occasionally for a few hours, until it may be presumed that the water is saturated. The bottle is then allowed to stand, without removal of the lime: and the liquid, which becomes perfectly clear, and remains so if not agitated, is poured off as wanted for use. The bottle should be well closed.

Lime-water is perfectly colourless and transparent, inodorous, but of an unpleasant acrid and alkaline taste. It affects litmus like the alkalies. The quantity of lime contained in it is very small; as water dissolves only about 9.7 grains in the pint at 60°; so that each fluidounce at ordinary temperatures contains about six-tenths of a grain. At a higher heat less is dissolved; at a lower more; the general rule of the solubility of bodies in relation to temperature being reversed. On exposure to the air, the solution rapidly absorbs carbonic acid, and an insoluble carbonate results, which forms a pellicle on the surface, and afterwards sinks; and thus the liquid may be nearly or quite deprived of the lime. This is the reason for the officinal direction to keep the water standing over lime. As fast as the carbonate is formed, the deficiency is supplied from the lime beneath, and the liquid is thus always kept saturated. Lime-water forms imperfectly soluble soaps with the oils.

Medical Effects and Uses. It is antacid, astringent, and locally

somewhat excitant. It exercises, moreover, an influence which cannot be referred to either of these properties, and of which the nature is not well understood. We may call it alterative.

One of the evidences of the peculiar influence referred to is its effect upon the stomach. In most cases of irritability of that organ, not dependent on acute inflammation, a mixture of equal parts of lime-water and fresh milk is perhaps as effectual as any other antiemetic medicine, with the single exception of opium. It sometimes succeeds most happily, when various other measures have been tried to no purpose. I have been much in the habit of using a similar combination, in cases of habitual vomiting, dependent on chronic gastritis. My plan is to put the patient on a *diet exclusively* of lime-water and milk, varying the proportion of the former from an equal measure down to one-quarter of the latter, as the stomach may seem to require. The vomiting sometimes ceases very speedily, after having been a long time previously uninterrupted. When the stomach becomes quite retentive, stale bread may be allowed in addition, and the diet otherwise gradually improved. I have also found great advantage in the middle and advanced stages of enteric or typhoid fever, when the stomach has been somewhat delicate, from giving a tablespoonful of each of these liquids every hour, except during sleep. The mixture at the same time nourishes the system, and quiets the stomach, instead of offending it, as other aliments are disposed to do. The lime probably reacts with the oily matter of the milk, producing a compound in which the taste of the lime is quite lost, and which exercises this extraordinary influence on the stomach. Incidentally, in these cases, it may also be sometimes useful by its antacid properties.

In the *acidity of dyspepsia*, it is occasionally given alone as an antacid; but so little of the lime can be administered that it can produce no great effect. It is more especially applicable when there is a tendency to diarrhœa present, and it is desirable to exercise a somewhat restraining influence. Taken to the amount of a pint or more in twenty-four hours, it has sometimes served a useful purpose in the *uric acid lithiasis;* but bicarbonate of soda is so much more powerful, and at the same time agreeable, that lime-water is not often used in such cases.

It is supposed to have the property of resolving chronic swellings and indurations, especially of a scrofulous character; but, since iodine has come into use, it has not been much employed for this purpose.

Externally, lime-water is considerably used. As a lotion in chronic cutaneous eruptions, and as a gently excitant and astringent wash in foul, flabby, and gangrenous ulcers, and those disposed to copious suppuration, it has not unfrequently proved more or less beneficial. Mixed in equal measures with olive or flaxseed oil, it is much used in burns. (See *page* 830.) It has also been used with occasional success, after failure with other measures, as an injection in leucorrhœa and gleet.

II. CARBONATE OF LIME.—CALCIS CARBONAS.

Three forms of carbonate of lime are officinal, all used mainly for antacid purposes.

1. PRECIPITATED CARBONATE OF LIME.—CALCIS CARBONAS PRÆCIPITATUS. *U.S.*

This is made by mixing heated solutions of chloride of calcium and carbonate of soda. Chloride of sodium forms, remaining in solution; and carbonate of lime is precipitated. A soft white powder is thus obtained, which may be employed for the same purposes as chalk, but has, so far as I am aware, no advantage over it in efficiency, which might counterbalance its greater costliness.

2. PREPARED CHALK.—CRETA PRÆPARATA. *U.S., Lond., Ed., Dub.*

Crude chalk is prepared for use by the processes of levigation and elutriation, by which it is reduced to the state of an impalpable powder. In the pasty state in which it is deposited by the water, in elutriation, it is caused to assume the form of little cones, in which it is usually kept in the shops. Prepared chalk is of a grayish-white colour, a soft feel, pulverulent, inodorous, and of a very slight peculiar taste. It is insoluble in water when quite pure, but is taken up by it in small proportion when containing carbonic acid; and as water ordinarily contains a small portion of this acid, it is capable of dissolving a little of the calcareous carbonate. Thus, *limestone water* is formed, in which it is probable that the lime is in the state of a bicarbonate. Chalk effervesces with acids. It always contains more or less impurity, but not sufficient, or of such a character as to impair its efficiency.

3. PREPARED OYSTER-SHELL.—TESTA PRÆPARATA. *U.S.*

This is prepared from oyster-shells, by first cleansing, then powdering, and lastly treating them by the process of levigation and elutriation, as in the instance of chalk. The preparation is usually also in the same form of little cones. This differs from prepared

chalk only in containing organized animal matter, intervening between the calcareous particles, so that, when the stomach acts upon it, the animal matter being dissolved, the oyster-shell is brought to the minutest possible state of division. This may render the preparation better adapted to an irritated stomach; and I have myself imagined that I have found it so in practice. At least, I generally prefer this form of carbonate of lime to any other for infants.

Medical Effects and Uses. Chalk and the analogous preparations unite a moderate astringency with a strong antacid power. Perhaps the astringency is not exactly of the same character as that of the vegetable astringents, but it at least promotes contraction of the tissues, diminishes the amount of secretion of the alimentary mucous membrane, and rather favours constipation of the bowels. Hence, this antacid is preferred to all others, when there is a coincidence of excess of acid in the stomach and bowels, with the existence of diarrhœa. Indeed, this complaint is not only attended with and sustained by acid matter, but not unfrequently has its origin in that cause, especially in infants. Hence, chalk is a very favourite remedy in diarrhœa, and is much prescribed in almost all cases, where there is not evidence of acute inflammation, or high vascular irritation. The same indication sometimes exists in chronic dysentery with rather copious evacuations. In these affections, it is almost always associated with other medicine, at the same time indicated: often with opiates, often too with vegetable astringents and aromatics, and sometimes with a little blue mass or calomel when the liver is torpid. These combinations are sometimes given in powder: but much more frequently in liquid mixture.

Prepared chalk is sometimes also preferred to other antacids, when, with acidity of stomach, there may be an apprehension of looseness of the bowels, without its positive existence.

It may seem strange that chalk should be disposed to restrain the bowels, while natural limestone water generally purges: as the carbonate of lime taken up is essentially the same as chalk in composition and properties. But, in limestone water, the neutral carbonate has probably been changed into a soluble bicarbonate, which may be laxative.

Chalk is one of the best antidotes for oxalic and sulphuric acids.

Administration. The dose of chalk is from ten to forty grains. Fifteen to twenty grains is a suitable quantity for each dose of a compound chalk mixture. This dose, in urgent cases, may often be repeated every hour or two until the discharges are arrested, or

the medicine has proved to be unavailing. In ordinary cases, it is given three or four times a day.

An officinal *Chalk Mixture* (MISTURA CRETÆ, *U. S.*, *Lond.*, *Ed.*, *Dub.*) is prepared, according to the U. S. directions, by rubbing together half an ounce of prepared chalk, two drachms, each, of sugar and gum arabic, and eight fluidounces of a liquid composed equally of water and cinnamon water. A tablespoonful, containing fifteen grains of the chalk, is the ordinary dose. In diarrhœa, an opiate, with or without kino or catechu in substance or tincture, may be associated with the mixture.

When the chalk is given in powder, it may be mixed with sugar and powdered cinnamon, with kino, catechu, or extract of krameria, and often with powdered opium or Dover's powder, according to special indications.

V. PREPARATIONS OF MAGNESIA.

Of these, *magnesia* itself, its *carbonate*, and sometimes its *bicarbonate* in solution, are used as antacids; but they have been already considered so fully that little else remains for us than simply to indicate that they belong to the class. (See *col.* ii., *pp.* 475 and 495.) One or two remarks, however, may be made here with propriety. The combining number of magnesia is, with the exception of that of ammonia, the lowest on the list of the antacids, and its neutralizing capacity, consequently, the highest. Hence, when the object is to neutralize a large quantity of acid in the alimentary canal, this is the article preferred. Its laxative property, after saturation, gives it also great advantages in certain cases. The general rule may be laid down, that, whenever there is occasion at the same time for a laxative and antacid, magnesia, or one of its carbonates, should be selected.

VI. CHARCOAL.

CARBO LIGNI. *U. S.*, *Ed.*, *Dub.*—CARBO. *Lond.*

This, though an antacid, has no power of combining chemically with and neutralizing acids; nor has it any dynamic influence whatever on the system. It acts only on the principle of absorp-

tion. My reasons for placing the remedy here have been already given. (See *page* 841.)

The charcoal used should be that prepared from the lighter kinds of wood, such as the willow and the poplar. The volatile matters should be completely driven off, the resulting charcoal then macerated in water to separate soluble impurities: and lastly, it should be thoroughly dried, put into bottles, and secured from the contact of the air.

An extraordinary property of charcoal, on account of which it is introduced here, is that of absorbing and condensing in its pores large quantities of different gases, and of exercising a similar influence over odorous, sapid, and colouring matters contained in organic products. It is thus, probably, that it is enabled to correct putrescency in animal matters, and it is thus, I have no doubt, that it sometimes proves useful as a medicine in the alimentary canal. In this situation, as elsewhere, condensing the offensive gases, it prevents their absorption and consequent elimination, and thus corrects foul breath. In like manner, abstracting from the alimentary contents any acrid, irritating substance, and among the rest acids, it retains them within its pores, and consequently obviates their irritant influence.

The affections, therefore, in which charcoal is indicated, are foul breath, putrid or otherwise offensive discharges as in bad cases of dysentery, gastrodynia, cardialgia, spasm of the stomach and bowels, and other disorders which may be supposed to depend upon irritant matter in the primæ viæ. Consequently, diarrhœa and dysentery are among the complaints in which it may be given.

As a dentifrice, it is useful not only by brightening the teeth, through the hardness of its minute particles, but by correcting the foul breath proceeding from carious teeth.

As an external application, it is employed, with the same view, in sloughing ulcers, burns, &c., where there may be offensive exhalations. For this purpose it is generally used in the form of *cataplasm*. The following formula for this is given by the London College, under the name of CATAPLASMA CARBONIS. Two ounces of bread, having been macerated near the fire, for a little while, with ten fluidounces of boiling water, are then mixed thoroughly with it, and, at the same time, with ten drachms of flaxseed meal gradually added. With the cataplasm thus made, two drachms of powdered charcoal are to be incorporated, and one drachm sprinkled on its surface.

CLASS II.

ANTHELMINTICS.

THESE are medicines calculated to remove worms from the alimentary canal. They effect this object in several ways.

1. By the increased peristaltic movement which they sometimes excite, they forcibly expel the worms. But when these parasites are of ordinary health and vigour, they have the power to maintain their hold in the bowels, against any force which can be brought against them, through the contractility of the bowels themselves. Still, active purgatives often do bring away worms; and we may infer that, under these circumstances, the parasites are off their guard, or debilitated.

2. Another and frequent method in which they probably act is by killing the worm. This they sometimes do mechanically, as by the sharp spiculæ of cowhage, which have been shown to have the power of killing them out of the body. Another method is no doubt by poisoning the worms, the susceptibilities of which are happily not the same as those of the body they inhabit; for some substances are very fatal to these animals, which have little or no effect on man. In the dead state, the worms, if in the stomach, are digested: if in the bowels, pass away with the feculent matter, or are subsequently expelled by purgation.

3. When they do not destroy, they probably often sicken the worms, and thus disqualifying them from maintaining their place, enable purgatives, simultaneously or subsequently given, to expel them.

4. Sometimes it is probable that the sensibilities of these animals are offended by substances swallowed, and they allow themselves to be carried off by the movement of the bowels, as if to avoid the offensive vicinity, or even make voluntary efforts to escape.

5. Some medicines combine a true anthelmintic virtue with a purgative property, at the same time poisoning or injuring the worm, and causing its expulsion, as large doses of the oil of turpentine, the bark of pomegranate root, and koosso.

6. Another anthelmintic measure is to put the stomach and

bowels into a condition unfavourable to the development and support of the worms, and thus ultimately destroy them, or at least co-operate with other methods for their extermination. Though it is probable that some worms are capable of living and flourishing in a healthy state of the alimentary canal, and will be developed whenever the germs find an entrance, as the tape-worms for example; yet there are others, which seem to require for their support a morbid state of the digestive function, and perish in the germ when this condition does not exist. We have no other means of accounting for the almost total absence of these parasites in certain conditions of the digestive organs, and their frequent presence in others, when the exposure to their cause, so far as can be ascertained, is the same in both. Thus, the round worm is so frequently found in all parts of the world, that their germs must be widely diffused, and probably there may be no individual living beyond a certain age into whose systems they have not found access. Yet in some they undergo rapid and vigorous development, in others die, or at least remain quiescent; and, in the same individual, it often happens that at one time circumstances shall be favourable to them, and at others unfavourable. Children are much more apt to be affected than adults; and the difference can be explained only upon the supposition, that there is a difference in the condition of the stomach and bowels, in the former congenial to the worms, in the latter adverse to them. What it is that constitutes the difference is not certainly known. Some ascribe it to a more abundant production of mucus in the one case than the other, serving as food for the animals; but in most cases any evidence of this superabundance is quite wanting, and when it exists, the condition is probably the result of an irritation produced by the worms, and not the cause of their development. The probability is that debility of the digestive process, permitting the accumulation of half digested crudities in the alimentary canal, is the main favouring influence; and consequently that the best anthelmintic measure is to invigorate the digestion, and thus prevent the accumulation of this nutriment for the parasites. Wholesome and digestible food, exercise, a regular condition of the bowels, and the judicious use of tonic measures, whether medicinal or otherwise, are probably efficient anthelmintics under such circumstances, both aiding in the extirpation of the worms when existing, and preventing their birth and growth when only in the egg. The bitters and chalybeates have probably acted as anthelmintics in this way.

It does not belong to therapeutics to treat of the origin, characters, and varieties of worms. These subjects belong rather to Pathology, and have been treated of in my work on the Practice of Medicine. I shall now, therefore, proceed to the consideration of the individual anthelmintics; taking it for granted that the reader has made himself acquainted with the several species of these parasites, known to infest the human bowels.

There are two methods of exhibiting anthelmintics; one to give them in full doses, either in connexion with purgative medicines, or followed by a cathartic in a few hours, should the anthelmintic itself not operate on the bowels; the other, to administer relatively small doses, morning and evening, for two, three, or four days, or longer, and then a brisk cathartic. I do not know that either of these methods has an absolute superiority; and one or the other may be adopted, as may seem most appropriate in any particular case. Not unfrequently the two plans are partially conjoined; that is, the anthelmintic and purgative are given together, in moderate doses, repeated once, twice, or thrice daily, so as to exercise a steady influence on the worms, and at the same time always be ready to expel them when they become sickened or debilitated.

I. PINKROOT.

SPIGELIA. *U.S., Ed.*

Origin. Though this medicine is little used abroad, yet, in this country, it stands at the very head of the medicines employed against the common round worm. It is the root of *Spigelia Marilandica* or *Carolina pink*, a very pretty herbaceous perennial, growing abundantly in our Southern and Southwestern States.

Properties. Pinkroot consists of a knotty head, and numerous slender, long, crooked, and branching radicles or fibres attached to it. Its colour is yellowish or grayish-brown, its smell faint and peculiar, and its taste sweetish and somewhat bitter, but not very unpleasant. The powder is grayish. Water and alcohol extract its virtues. The active principle has not been satisfactorily isolated; though Feneulle obtained from it a brown, bitter, nauseous matter, which, when taken internally, produced some of the characteristic effects of the root.

The leaves have similar virtues with the root, but are much

feebler, and have been very properly, I think, rejected by our officinal code. They were formerly more used than at present.

Remedial Effects and Uses. Though not employed with reference to its effect on the system, pinkroot is not without some power of affecting the functions. Taken somewhat more freely than is ordinarily considered necessary for its anthelmintic effects, it occasionally operates as a cathartic; but not certainly; so that it cannot be relied on in this capacity. Another effect which it produces in large doses, and which is occasionally seen from it in nervous children, when given moderately as an anthelmintic, is disturbance of the nervous system; as indicated by giddiness, dimness of vision, dilated pupil, and irregular muscular contractions, amounting sometimes to convulsions. Ludicrous distortions of the facial muscles are often noticed, and especially spasmodic movements of the eyelids. Death in two instances has been thought to proceed from convulsions dependent on this cause in children; but the affection is so common from other causes in the very young, even from the worms themselves, that it would be extremely difficult to determine, with certainty, in any particular case, that the fatal result and the administration of the medicine were anything more than coincidences. Though I have witnessed some of these nervous disturbances in children, I never saw an instance in which I thought there was danger of life; and within the circle of my personal observation, I have never heard of such a case. These effects on the nervous system scarcely ever occur when the medicine purges; and hence the propriety of the simultaneous administration of a cathartic with this particular anthelmintic.

Experience has, I think, abundantly established the efficiency of pinkroot as an anthelmintic. A knowledge of this property of the medicine was derived from the Cherokee Indians, in whose original country, the plant grew abundantly; and to Drs. Lining, Gardner, and Chalmers, of South Carolina, the profession are indebted for its first introduction to their notice.

Administration. Spigelia is given in substance, infusion, or fluid-extract. The *dose* of the powder is for a child three or four years old from ten to twenty grains; for an adult one or two drachms. When the medicine is given in single doses with a purgative, the larger quantity may be administered; when in doses repeated twice or more frequently in the day, the smaller.

Sometimes a full dose of the powder is given at once with a purgative dose of calomel, and repeated at intervals of three or four

days; care being taken in regard to each dose, that, if it do not operate in six or eight hours, it should be followed by a dose of castor oil. For children, the compound is conveniently given at bedtime, and the oil, if required, next morning.

Another method is to administer a dose of the powder morning and evening for several days in succession, and follow it by a brisk cathartic, which, in the cases of children, may be a dose of calomel, in adults of senna tea with sulphate of magnesia.

The *infusion* is more used than the powder. It is sometimes given alone, repeated as above, and in like manner followed by a purgative; but a more frequent plan, and, I think, a better, is to give it in connexion with senna, according to a formula which will be mentioned below.

Recently the *fluid extract* has come into extensive use, and, as it concentrates the virtues of the medicine within a small bulk, and is thus more easily administered, is generally preferred.

Infusion of Pinkroot (INFUSUM SPIGELIÆ, *U. S.*) is made in the proportion of half an ounce of the root to a pint of boiling water. The dose for a child, from two to four years old, is from half a fluidounce to a fluidounce, for an adult from four to eight fluidounces, morning and evening. It is rendered more efficient by the addition of half an ounce of senna, and, in order to obviate the griping effect of this cathartic, a drachm or two of cardamom or fennel seed, and an ounce of manna. Some add a little savine; but, in view of the poisonous character of that medicine in overdoses, it would be best omitted.

Fluid Extract of Pinkroot and Senna (EXTRACTUM SPIGELIÆ ET SENNÆ FLUIDUM, *U. S.*) is also an officinal of the U. S. Pharmacopœia. Besides spigelia and senna, it contains sugar and aromatic oils to give it flavour and obviate griping, and a little carbonate of potassa, which answers the double purpose of holding a resinous matter in solution, and correcting the action of senna. It is an excellent preparation, and easily administered. The dose is a fluidrachm for children, half a fluidounce for an adult.

II. WORMSEED.

CHENOPODIUM. *U. S.*

Origin. All parts of the *Chenopodium anthelminticum*, *wormseed*, or *Jerusalem oak*, abound in a highly odorous, volatile oil, upon which the anthelmintic virtues of the plant depend, and all, therefore, possess more or less efficacy; but the fruit, as the strongest and most uniform product, and that which keeps best, is the only part officinally recognized. The plant is an indigenous perennial herb, growing in most parts of the United States, but most abundantly in the southern section. It is also cultivated for medical purposes.

Properties. The fruit is globular, about the size of a pin's head or smaller, of a dull greenish-yellow or brownish colour externally, a strong, peculiar, disagreeable odour, and a bitterish, pungent, somewhat aromatic taste. If rubbed in the fingers, these grains lose an exterior coating which invests them, and have a shining black colour. The volatile oil, upon which their efficacy depends, is separated by distillation. It is officinal, and will be considered below among the preparations. The seeds yield their virtues to alcohol, but only in a slight degree to water.

The fruit of the *Chenopodium ambrosioides* is said sometimes to be mingled with or substituted for the genuine. But as we want evidence of its equal efficiency, the mistake or fraud should be guarded against. The odour of this species is weaker than the other, and rather agreeable than offensive.

Medical Uses. The effects of wormseed on the system are probably somewhat stimulant, especially upon the nervous centres; but its operation has not been satisfactorily investigated. It is certainly among our most efficient anthelmintics, though much less used than spigelia, probably in consequence of its unpleasant and adhesive odour, and disagreeable taste. It may be given in the shape of powder or volatile oil.

The *dose* of the powder, for a child two or three years old, is from twenty to forty grains, and four times the quantity for an adult. It may be given, mixed with molasses or syrup in the form of an electuary, in the morning before breakfast, and at bedtime, continued thus for three or four days, and then followed by a dose of calomel, or other brisk cathartic.

Oil of Wormseed (OLEUM CHENOPODII, *U. S.*) is of a light yellow colour, deepening by age, lighter than water, and of a very strong, diffusive, and permanent odour, which is the greatest impediment to its use. In over-doses it is probably capable of producing dangerous, if not fatal effects. From four to eight drops is the dose for a child from two to four years old. It may be administered in sweetened water, mucilage, or milk; but should always be diluted.

III. AZEDARACH. *U. S.*

This is the bark of the root of *Melia Azedarach*, *pride of China*, or *pride of India*, a large and beautiful tree, indigenous in Asia, but naturalized in the Southern parts of the United States, where it is much used as an ornament to the towns and villages.

Though other parts of the plant are not without anthelmintic properties, the bark of the root is the most active, and the only portion recognized by our national pharmaceutical code. It has a bitter nauseous taste, and yields its properties to boiling water. Being considered most efficacious in the recent state, it is seldom kept in the shops; and, therefore, has been little employed in the Northern States. But in the South it is considerably esteemed, and has been much used in some districts.

In relation to its effects on the system, the bark generally operates on the bowels in the regular doses, and, if these be exceeded, sometimes proves emetic. It is said also, when largely taken, to produce narcotic effects similar to those produced by spigelia. It is usually administered in decoction; four ounces of the fresh root being boiled with two pints of water to a pint, of which the dose for a child from two to four years old is a tablespoonful every two hours till it purges, or night and morning for several days, and then followed by a cathartic.

IV. EUROPEAN WORMSEED.

SANTONICI SEMEN.

Origin and Properties. This is the product of different species of Artemisia, growing in Asia and the North of Africa. There are at least two varieties, corresponding with the commercial source from which they are derived; one called Aleppo, Levant, or Alex-

andria wormseed, brought from the Eastern parts of the Mediterranean, and the other, Barbary wormseed, from the African coast. It is a mistake to call the product seeds. It consists of the unexpanded flowers, with the peduncles attached or separate, and minute leaves or fragments of leaves. A whitish down covering the Barbary wormseed distinguishes it from the Levant, which has a greenish colour. Both have an aromatic odour, and a bitter, disagreeable taste.

Active Principle. Though European wormseed contains a volatile oil, it is supposed that their anthelmintic virtues depend upon a peculiar principle contained in them called *santonin.* This is crystallizable, colourless, inodorous, and at first, on account of its insolubility, almost tasteless; but after a time it produces a slightly acrid impression, and its alcoholic solution is bitter. It is nearly insoluble in water, but is dissolved by ether and alcohol. With the alkalies it forms crystallizable salts, and would seem, therefore, to be an acid. For the mode of procuring it, see U. S. Dispensatory (10th ed., p. 1404).

Medical Effects and Uses. The general effects of this remedy are probably those of a mildly stimulating tonic; but it is exclusively for the sake of its vermifuge properties that it is employed. It appears to hold the place in general estimation in Europe, which spigelia holds with us. At present, however, the active principle santonin is preferred by many, on account both of its vermifuge energy, and its want of taste.

From some careful experiments of Dr. Küchenmeister, made upon worms placed in an albuminous liquid, kept constantly at the temperature of 77° F., it appears that an oleaginous solution of santonin killed the round worm sooner than any other anthelmintic, even the most powerful, which he tried. (*Arch. Gén.*, 4e sér. xxix. 206.) It is probable, therefore, that this is one of the most effective of the anthelmintics; but, from its insolubility in water, it should be administered dissolved in oil. In over-doses, it seems to act as an acrid poison, causing severe abdominal pains, with vomiting, purging, cold sweats, and great prostration.

The dose of European wormseed in substance is from ten to thirty grains, repeated in the same manner as spigelia. The average dose of santonin for a child is one-third of a grain twice a day. Three grains are said to have produced alarming symptoms in a child four years old. From 2 to 5 grains may be dissolved in a fluidounce of castor oil, and a teaspoonful given for a dose.

V. COWHAGE.

MUCUNA. *U.S., Lond., Ed.*

This consists of the bristles of the pods of *Mucuna pruriens* (*Dolichos pruriens*, Linn.), a perennial climbing plant of the West Indies and other parts of intertropical America. The fruit, which is a dry pod shaped like the italic letter *f*, is thickly covered with short reddish-brown hairs, which are very hard and sharp at the point, and easily penetrate the skin when brought into contact with it. I once accidentally took a quantity of these hairs in my hand, and suffered considerably for some hours.

These spiculæ are supposed to possess anthelmintic properties, and to act on the worms mechanically, by wounding them. In experiments made out of the body, worms mixed with them have seemed by their motions to suffer severely, have died as from the effects of the injury, and afterwards, examined by the microscope, have exhibited great numbers of these little spears penetrating their bodies, and sometimes passing through them. They have been chiefly employed against round worms, but are said to have proved successful against all the varieties. Dr. Küchenmeister, however, did not find them, in his experiments, to produce any effects on the tape-worm. (*Dub. Journ. of Med. Sci.*, xv. 250, from *Froriep's Tagsberichte.*) The dose of cowhage is not precise. The ordinary method of exhibition is to mix the hairs scraped from the pods with molasses or syrup, so as to form a semifluid electuary, of which a teaspoonful may be given to a child three or four years old, and a tablespoonful to an adult.

VI. MALE FERN.

FILIX MAS. *U.S.*—FILIX. *Ed.*

Origin. *Aspidium Filix mas*, or *male fern*, is a European plant, with a horizontal root or rhizome, from which numerous fronds or leaves rise, to the height sometimes of three or four feet. It has been thought to be also a native of the United States; but there seems to be some doubt about the perfect identity of the two plants, and the probability is that they are not of the same species.

The root or rhizome, as taken from the earth, is long, cylindrical, and closely invested with the remains of the footstalks of the fronds, between which appear brown silky scales, with radical fibres emerging. But, as in the shops, it is generally much broken up, so as to exhibit little of its original appearance when whole. The proper root is brownish externally, yellowish or reddish-white internally, of a faint but peculiar odour, and a sweetish, astringent, bitterish, and nauseous taste. Water but imperfectly extracts its virtues.

Though the active principle has not been obtained in a pure state, Peschier has made the important discovery, that its virtues reside in the ethereal extract. This is a thick, dark liquid, with the odour of the root, and a bitterish, subacrid, nauseous taste, and consists of fixed oil, volatile oil, resin, &c. The male fern root, found in the shops in this country, has generally been so much deteriorated by time, as to be of little value; and the remedy had fallen into almost entire neglect, when the fact was ascertained that it was possible to obtain its properties in a concentrated and permanent form. Now that we can, by importation, provide ourselves with the ethereal extract, prepared from the root in its fresh state and highest activity, we may hope to realize in our own experience, what has not yet been done, the great efficacy of the remedy in tape-worm, established beyond doubt by abundant experience in Europe.

Medical Effects. Male fern has little effect on the human system. It may be slightly tonic, but it is only for its anthelmintic properties that it is employed. These were known to the ancients, and did not of course entirely escape the attention of the diligent students of the old Greek and Roman medical writers; but the profession in modern times were generally quite ignorant of them; so that the announcement that male fern was the chief ingredient of Madame Nouffer's famous specific took them by surprise. It is unnecessary to repeat the so often told tale, of the reputation of this nostrum in the cure of tape-worm, of the purchase of the secret by the king of France, and of its public announcement about the year 1775. It acquired immediately great reputation, and was submitted to many trials, the general result of which has been favourable to the efficiency of the remedy, though it not unfrequently fails, and is certainly not entitled to the name of a specific. It is chiefly in the treatment of the common tape-worm that it is still employed. Dr. Küchenmeister found the ethereal extract to destroy the tænia, out of the body, in from three and a half to four hours, while, under the action of castor oil, the worm lived eight

hours; so that it has certainly considerable anthelmintic virtue, though much inferior, according to his experiments, to the oil of turpentine and koosso. The medicine should be given in powder or ethereal extract. The dose of the powder is from a drachm to half an ounce, which may be administered mixed with syrup in the form of an electuary, or suspended in the state of liquid mixture, and repeated morning and night on an empty stomach, for one, two, or three days, and then followed by a brisk cathartic. The ethereal extract may be taken in the dose of from fifteen to twenty-five drops, or about the same number of grains, repeated, and followed by a cathartic, as in the case of the powder.

VII. POMEGRANATE ROOT.

GRANATI RADICIS CORTEX. *U. S.*—GRANATI RADIX. *Lond., Ed.*

Origin. The medicine here referred to is the bark of the root of *Punica Granatum*, or *pomegranate-tree*, which is almost universally diffused throughout tropical regions, and grows wild in so many places, that botanists have been unable to determine with certainty its original country. It is the product of the wild plant which is most esteemed; that of the tree cultivated in gardens for its fruit, or the beauty of its flowers, being considered much less efficacious.

Properties. As found in our shops, the bark is in broken pieces or quills, of a grayish colour on the outer surface, yellowish on the inner, brittle with a short fracture, inodorous or nearly so, and of an astringent taste. It gives a yellow colour to the saliva when chewed. Nothing has been discovered which can claim to be considered as its active principle.

Medical Effects and Uses. This bark has some astringent effect on the system, and, when given largely, produces nausea, vomiting, and purging. Known to the ancients as a vermifuge, it seems to have been quite forgotten in Europe, when the use of it was revived, in consequence of favourable accounts brought from Hindostan of its successful employment by the natives in the tapeworm. It certainly is not without efficacy in this complaint. The numerous reports in its favour, based upon experience, are sufficient proof of this fact, though it certainly often fails, and has not fulfilled all the expectations that were at one time indulged. It takes

rank with the male fern, to be employed in tape-worm, in the succession of remedies through which those affected with this malady are too often compelled to pass, before the effectual one is found at last. According to Dr. Küchenmeister's experiments, before referred to, it is much inferior to the oil of turpentine and koosso, and about on a level with the male fern.

The medicine may be used in powder or decoction; but the latter form is almost always preferred. It is advised that, on the day previous to its exhibition, the bowels should be evacuated by castor oil, and the patient diet rigidly, so that the worm may be exposed unprotected to the action of the medicine. Two ounces of the bark are boiled in two pints of water to one pint, of which a wineglassful may be taken every half hour or hour, till the whole has been swallowed, or its action on the stomach and bowels becomes excessive. Should the plan fail, it may be repeated every day or two, as the patient may bear it, either until the worm appears in the evacuations, or the insufficiency of the remedy has been satisfactorily determined.

VIII. OIL OF TURPENTINE.

OLEUM TEREBINTHINÆ.

The oil of turpentine has been so fully considered in all its medicinal relations, that nothing more is necessary here than to treat of its character as a vermifuge. Until the introduction of koosso into use, this medicine stood at the very head of the remedies employed against the tape-worm, and is still second only to that anthelmintic. As a general vermifuge, it is among the most effectual; and may be given, with good hope of advantage, in any case of worms, in which it may not be contraindicated by the state of the system. In the round worm, however, it is probably inferior in efficiency to several others in habitual use, as spigelia, and American and European wormseed.

But even in this variety of worm, it seems to be peculiarly efficacious, when, as sometimes happens, the animal finds its way into the stomach. The late Dr. Joseph Klapp, of Philadelphia, first, I believe, called attention to this application of the oil; and I have had occasion to confirm his observations in regard to it. The medicine here comes into action against the worm with its full force, without having previously been diminished by absorption,

or impaired in activity by dilution in its passage through the bowels. It must not, however, be expected that the worm should always be discovered in the evacuations. If killed in the stomach, it would undergo digestion, like any other dead animal matter.

In the treatment of ordinary worms, it may be used in moderate doses; but for the tape-worm, much larger quantities are required than medical men are in the habit of using for other purposes. Yet they seem to be very well borne by the system, and I have never personally known any evil effects accrue from them. For the phenomena resulting from these large doses, the reader is referred to the article on oil of turpentine as an arterial stimulant. Of its relative efficiency, independently of the general results of experience, we have the evidence of Dr. Küchenmeister's experiments, who found the oil to destroy the tape-worm in from an hour to an hour and a half, while three hours or more were required by the ethereal extract of fern, and the bark of pomegranate root. (*Arch. Gén.*, 4e sér., xxix. 205.) Very often the worm, or a part of it, comes away in two or three hours, with the first cathartic operation of the oil. If the first trial should not succeed, or should be partial only in its effects, it may be repeated in the course of a few days, with an increase of the dose, until the outside limits are attained to which it may be safe to go.

Administration. For the *round worm*, or *long thread-worm*, a fluidrachm of the oil may be given twice or three times a day to an adult; from five to twenty drops to a child, according to its age, from one to six years. After three or four days, a dose of castor oil should be given, or, in children, a purgative dose of calomel. For the *small thread-worm*, or *seat-worm*, the oil should be administered by enema; at least two fluidounces being employed at one time, made into an emulsion with eight fluidounces of water, by the intervention of mucilage, or the yolk of one or two eggs. For the *tape-worm*, from half a fluidounce to two fluidounces should be given at once, followed, if it do not act on the bowels in two hours, by a full dose of castor oil. Some recommend the simultaneous administration of castor oil; but I doubt the expediency of this plan; as the oil of turpentine, for full effect, should be left for an hour or two in contact with the worms. It is affirmed that much smaller doses of the oil, as one or two fluidrachms, for example, taken morning and evening for several days, has proved equally effectual. But the probability is that, in these doses, more inconvenience would be

experienced from the absorption of the oil, than from a full purgative dose given at once.

The oil may be exhibited dropped on sugar, or in emulsion with mucilage or the yolk of eggs and some aromatic water, or simply floating in water flavoured or not as the patient may desire. Sometimes it is drank from the wineglass without dilution.

IX. KOOSSO.

Origin and Properties. I adopt this spelling of the word, because it properly represents the sound. The medicine consists of the flowers of *Brayera anthelmintica*, a small tree, growing in the high grounds of Abyssinia, where its product has been used from time immemorial as a vermifuge. The flowers are imported packed in boxes. In mass they have a greenish-yellow colour, and, though packed closely, retain the shape of the clusters in which they are taken from the tree. One of the characters of these clusters is the division and subdivision of the stems of the flowers into two branches. They have a fragrant odour, and a taste slight at first, but in the end acrid and disagreeable. Their activity probably resides in an acrid resinous principle; but this point has not been sufficiently tested. Their aqueous decoction is not without efficiency, but is not equal to the medicine in substance. The decoction in milk appears, from the experiments of Küchenmeister, to be especially powerful. It killed the tape-worm out of the body in half an hour; whereas the ordinary decoction required from an hour and a half to three hours to produce the same effect. (*Arch. Gén. ut supra.*)

Medical Effects and Uses. Koosso has little effect on the human system, at least in the quantities commonly administered. In the dose given for the tape-worm, it usually produces some uneasiness of the stomach, more or less nausea, and occasionally a cathartic effect. It has been equally efficacious in both kinds of tape-worm. Trials with it have now been sufficiently numerous to prove its extraordinary powers. Though noticed by Bruce in his travels, it was first introduced to public notice in Europe, by a treatise published in 1823, in Paris, by Dr. Brayer, a French physician who had been practising in Constantinople, and had become acquainted with the virtues of the remedy in the East. In Küchenmeister's experiments, it far exceeded all other anthelmintics in the rapidity of its poisonous action on the worm. As above stated, it killed the tænia in

half an hour, when applied in the form of a decoction in milk. It has already been stated that the oil of turpentine, the next to it in power, required from an hour to an hour and a half, and castor oil required eight hours. A singular result of these same experiments is, that the medicine should have proved almost or quite inert in its action on the round worms. Thus, while *santonin* killed the round worm in an hour, koosso did not produce the effect under fifteen hours, and took rank with gentian, anise, and camphor. (*Ibid.*, p. 206.)

Administration. The ordinary mode of exhibiting koosso, is to give the flower itself in powder. The dose is half an ounce for an adult, to be diminished for children, though in somewhat less proportion than is requisite, in relation to medicines more energetic than this in their action on the human system. The worm probably requires as much to poison it in a child as in an adult; but, from the comparatively small extent of bowels in the former, a larger proportion would come in contact with the parasite in a given time. To a child two or three years old the dose may be from one to two drachms. The medicine should be taken on an empty stomach, and the previous administration of a cathartic is desirable. The powder should be stirred up in half a pint of warm water, and taken in two or three draughts at short intervals, to obviate nausea. Should no operation take place upon the bowels in three or four hours, a dose of castor oil or other brisk cathartic should be given. In general, more or less of the worm, and not unfrequently the whole of it, comes away after the administration of a single dose. If not, another trial may be made in a few days, and the dose increased, even to an ounce if found necessary.

X. PUMPKIN SEEDS.

PEPONIS SEMEN.

Much attention has recently been drawn to the seeds of the common pumpkin, *Cucurbita Pepo*, as a remedy in tape-worm. Something has been long known of the presumed efficacy of these seeds; but it is from statements published in our own journals of their efficiency in individual cases, that they have recently come into notice, whether in Europe or this country. The reader will find a brief history of the remedy in the appendix of the tenth edition

of the U. S. Dispensatory (*page* 1323). Since the publication of the statements there made, other confirmatory evidence has been adduced, and a second case has fallen within my own knowledge, which had gone through a course of treatment with all the most efficient remedies in tape-worm, koosso alone excepted, with but partial effect, in which the pumpkin seeds proved promptly successful. There seems little room to doubt their extraordinary efficiency; I say extraordinary, in consideration of their perfect blandness and harmlessness, so far as is known, in their action upon the human economy. Two ounces are usually given for a dose. Like the other anthelmintics, they should be taken upon an empty stomach; and the best period of the day is the morning, before breakfast. They may be administered in the form of an electuary, prepared by first depriving them of their outer covering, and then rubbing them into a paste with sugar and a little water. But a more elegant plan is to form them into an emulsion, by rubbing them thoroughly first with a little sugar, and then with from eight to twelve fluidounces of water gradually added. The whole quantity should be taken on one occasion, but in successive draughts. In about two hours, they should be followed by a full dose of castor oil.

XI. CALOMEL.

We have so often repeated the officinal title of this medicine, that we may be excused for adopting here, at the close, the simple name which preceded all the others, and will probably survive them. There seems, in the influence of mercury, something even more noxious for the lower grades of animals than for man. In Magendie's *Journal de Physiologie Expérimentale* (i. 105) is an account of experiments by M. Gaspard, which prove the extraordinary incompatibility of the mercurial influence with insect life. It is well known that solutions of corrosive sublimate, of very moderate strength, are among the most effective poisons for the animals that infest the exterior of the body. The biniodide of mercury is said to be still more effectual. It seems also that they are equally poisonous to the parasites of the interior, when they can be brought into contact with them. Küchenmeister found the round worms to be killed by corrosive sublimate in from one to two hours. But the difficulty is to bring these soluble salts of mercury in contact with the worms in the small intestines, without administering them

so largely as to be hazardous to the patient. The same is not the case exactly with the thread-worm, upon which they can be brought to bear directly. Trousseau and Pidoux have found injections of the biniodide and bichloride of mercury extremely effective in ascarides of the rectum. To an adult they administer, two or three days successively, an enema consisting of a quart of water, in which five centigrammes (about three-fourths of a grain) of the biniodide are dissolved, by means of one-tenth of iodide of potassium, or they use the same quantity of corrosive sublimate without such addition. To children only one-fourth or one-fifth of this quantity is given. They have rarely failed of success. They advise the repetition of the remedy a fortnight afterwards, and another repetition at the end of four or five weeks. (*Trait. de Therap.*, &c., 4e ed. i. 209.)

Calomel has long enjoyed great reputation as an anthelmintic against the round worm; and it is certainly among the most efficacious. On the tape-worm it produces little effect. It is possible that, as slowly dissolved through the agency of the chlorides in the bowels, it may act on the worm directly with a poisonous influence; but it has probably also another mode of action. Every physician must have noticed that, in attacks of bilious vomiting and purging, or of bilious diarrhœa alone, round worms, if existing in the bowels, are apt to be evacuated. It is probable that they are poisoned, or rendered uncomfortable and debilitated, by the same irritant influence of the morbid bile, which causes spasm of the stomach and bowels, with cholera or diarrhœa, in man. Now calomel is characterized by the abundance of the bilious discharges which it provokes, and these, too, not unfrequently of a highly irritant character. It is probable, therefore, that it acts as a vermifuge mainly through the acrid bile, the production of which it stimulates. Adding this effect to its poisonous action as a mercurial, and its purgative operation, we can well understand how the medicine should have obtained the reputation it has long possessed in this respect.

Calomel is given as an anthelmintic in the ordinary purgative doses. (See *vol.* ii., *p.* 545.) It is most conveniently administered at bedtime, and followed by a dose of castor oil in the morning, so as to insure its action on the bowels. It is peculiarly adapted to infantile cases, and may with great propriety be given in connexion with spigelia, or any other ordinary vermifuge.

The above list of anthelmintics includes the most effective substances belonging to this class; but it might be greatly extended; for there is a very large number of substances, possessed of more or less vermifuge power, which have been and still are occasionally used. Among these may be particularized *olive oil*, *castor oil*, *croton oil*, *black hellebore*, *gamboge*, *colocynth*, *scammony*, and *cevadilla*, belonging to the cathartics; *quassia*, *wormwood*, and *tansy*, to the tonics; *assafetida*, *valerian*, and *garlic*, to the nervous stimulants; *camphor*, to the cerebral stimulants; *tobacco* and *peach leaves* to the nervous sedatives; *creasote* and *petroleum* to the stimulating diuretics; and *rue*, *savine*, and our native *Juniperus Virginiana*, to the emmenagogues. Among mineral substances, the *powder of tin* and *iron-filings*, which act mechanically, and *lime water*, *common salt*, *tartar emetic*, *sulphate of iron*, and *arsenious acid*, which are supposed to poison the worms, may also be added to the catalogue. Almost all of these have been treated of in different parts of this work, and their supposed anthelmintic virtues incidentally referred to.

With these observations on anthelminties I close the treatise. It does not pretend to be a complete history of all that is known, or has been written on the subjects of therapeutics and pharmacology. My aim has been to include in it whatever is directly and practically important to the physician; and to the accuracy of the great mass of facts stated, where no reference is made to authority, I can bear testimony from my own observation and experience. How far I have succeeded in my aim, the judicious reader will be best able to determine. If the work should prove useful in proportion to the labour it has, in various ways, cost me, it will more than accomplish all my expectations.

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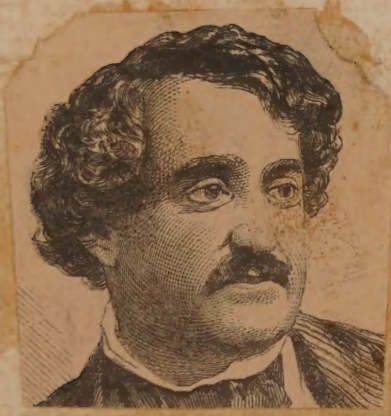
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